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NEW YORK, SATURDAY, NOVEMBER 25, 1899.

CONTENTS.

	Page
Editorial	807
The Statistics of Our Growing Foreign Trade	810
Activities in the Independent Telephone Field	810
The New Station of the Kings County Electric Light and Power Company, by George T. Hanchett	811
The Electric Plants of the Battleships Kearsarge and Kentucky—I	813
Arguments in the Berliner Telephone Case	819
Favorable Navy Report on Wireless Telegraphy	820
Annual Meeting of the National Municipal League	820
American Trade Press Association	821
Report on Tests of the Holland Submarine Boat	821
Current News and Notes	821
LETTERS TO THE EDITORS:	
Protection of Interior Wiring from High Potential Currents, by Warren B. Reed	823
A Multiple Lightning Flash, by Theo. Reyman	824
Professional Degrees, by Arthur L. Rice and F. C. Caldwell	824
Digest of Current Electrical Literature, Compiled by Carl Hering	825
New Books	830
Pole Line Insulators	831
Compensated Revolving Fie'd Generators	831
Carbon Works Damaged by Fire	833
The Voltamp Dry Cell	833
Excitant for Primary Batteries	833
The Collis Valve	833
DEPARTMENTS:	
Financial Intelligence	834
Commercial Intelligence	834
Special Correspondence	836
General News	839
Personal	840
Legal	841
Trade and Industrial Notes	841
Record of Electrical Patents	841

FOUR COMPETING TELEPHONE EXCHANGES.

Just to what extent the doctrine of a "natural monopoly" applies to the telephone exchange and is accepted by the public, we are unable to say. Bell telephone men are firm in their conviction that one network in any city is correct and enough. "Independent" telephone men by starting an opposition, as they have done in so many places, might be assumed to discredit or disbelieve the doctrine, but it is by no means improbable that several of them expect an ultimate reduction again to one service, when a man will be asked to put only one telephone on his desk or wall and use but one telephone directory. This is a practical and serious question, but it does seem to have a ludicrous aspect given to it when, all of a sudden, as in New York City at this moment, we are threatened with anywhere from four to six competing exchanges.

New York has to-day the largest local telephone exchange system in the world, under Bell control, and that will probably go on operating with its 30,000 subscribers. It is now stated that the People's Company, fostered by the New York Board of Trade and Transportation, will push its work in absolute independence, and having some 7000 subscribers pledged, will put in its system. But the new and powerful Widener-Maloney syndicate is in the field and will have a system, which we will assume, merely for the sake of argument, will be represented by the Eckert Knickerbocker Telephone Company. But now another company, the Universal, comes forward and promises to start an exchange; and back of all these, one or two other plans lurk, with more or less definiteness.

Now, conceding that two telephone exchanges can exist side by side in a large city—and it is a present condition—it does seem straining common sense to ask public support for four or five systems at once. The annoyance and inconvenience endured by the public would be nothing short of monumental, for there comes a time when even the greatest blessing of civilization may carry a curse. We have heard, authentically, of a loving wife who was compelled to secure a divorce because her husband would insist on buying and using every new device for domestic economy that was put on the market. Her kitchen became as distressful as would be the office of a busy man subscribing to five distinct telephone exchanges. There may be hardships for some people in the present "monopolistic" telephone situation in New York, but it would hardly seem feasible for any one to take all five services as a remedy; and yet if he does not he may be discriminating against his real benefactors. Still it is doubtful whether capital can be raised for all the four or five exchanges, and the situation may be hoped to clear up within a week or two. So far as subway rights go, three is the actual number of possible competitors in sight, and even warm believers in a free and open field, like ourselves, might regard it as a merciful interposition of Providence if there were no more.

LEGALITY OF A MINIMUM MONTHLY ELECTRIC LIGHT RATE.

A case recently came before a New York court testing the legality of a minimum monthly charge for electric light. The defendant contested such a charge as unreasonable when he only used a quantity of light which, calculated at the lamp-hour rate of charge, amounted

to less than the minimum monthly charge. Among the grounds given by the plaintiff in support of its contention of reasonable charge was that each additional lamp connected with its system necessitated an additional investment in distributing conductors and local appliances of about $20, in addition to the cost of generating and delivering the lighting current. In the case in suit there were eleven lights installed, thus involving a total additional investment in order to comply with the defendant's demand for service, of about $220. In the opinion of the Court sustaining the minimum rate, some interesting points of law were laid down as affecting charges for quasi-public service, and particularly as affecting charges for electric light service.

The Court held that while the New York statutes require under certain conditions the supply of electric lighting on demand, the State does not undertake to regulate the price at which such lighting shall be supplied, nor to limit or define what compensation may be exacted, beyond that it shall be reasonable and uniform; nor does it require the amount charged to be separated into items with respect to its constituent elements. While the customer does not bind himself to use any particular amount of light, the constant readiness to meet instantaneously his demands forms part of the service to be rendered, and is therefore an item as properly to be considered reasonable as that for the light actually supplied. The minimum charge, therefore, may not be considered a penalty for a failure to use a product, but is properly to be regarded as compensatory for that part of the service which renders available to the customer the production of light at his pleasure. The learned judge in laying down the law applying to the case in suit, was probably not aware that he was also strongly stating some of the arguments of the advocates of the maximum-demand system of charges for electric lighting. That the maximum demand system is based on equity is now generally recognized, and it is interesting to have this testimony as to its legal justness.

INCIDENTAL USES OF SERIES FIELD WINDINGS OF COMPOUND DYNAMOS.

The early practice of connecting a compound-wound generator to the bus bars through a triple-pole switch operated by one handle has fortunately largely gone out of fashion. In connecting a fresh generator in parallel with others running under load, the series field should, as is well known, be paralleled before the armature. The old provision of a switch blade for the equalizer projecting further than the positive and negative blades was a weak attempt to obtain this object. The series field is not paralleled until the equalizer and positive main both go in, and even if both these blades were made to project further than the negative, the time interval would be so short as to be almost negligible. The series field of the fresh machine should, of course, be thrown in parallel with the other series fields—so as to get its proportion of the total output—before the voltage of the fresh machine is adjusted to equality with that of the others. Under this condition the closing of the final switch causes no disturbance of the regulation.

This is provided for in all modern plants by a division of the switches. As a rule, three single-pole switches are used for each machine, one on the positive, one on the equalizer and one on the negative lead. By closing the positive and equalizer—assuming that the series field is on the positive side of the system—the series coils of the fresh machine are paralleled with the series coils of the other machines, and presumably get their proper proportion of the rated output; consequently, when the armature of the machine is thrown into service, they get no more and no less, and there is no jump of the voltage of the fresh machine to cause a disturbance of the line pressure.

The same result may be obtained by means of one double-pole and one single-pole switch for each machine, the double-pole controlling the positive and equalizer leads and the single-pole controlling the negative lead. By closing the double-pole switch, the series field is paralleled, after which the voltage may be adjusted and the armature thrown in. This arrangement has a slight advantage over the use of three single-pole switches in that it prevents confusion of the various switches. Incidentally the division of the switches makes available several interesting expedients and tests. If the shunt fields are connected across their own brushes instead of across the bus bars, the reversal of the field may be readily cured by killing the shunt field and throwing in the series field, which will set up a partial magnetization of the proper polarity. This method is in quite common use.

The division of the switches also allows a very simple test to be made of the condition of the equalizer without any special wiring or instruments. Assuming that there are two machines and that one is running under about half-load, the switches can be readily thrown so as to pass the whole output of machine No. 1 through the series field of machine No. 2. By running No. 2 up to speed with its negative switch and its shunt field circuit open, the voltage set up in its armature by the excitation of its series field can be measured. At some other time when there is just full load for machine No. 1, the two series field may be thrown in parallel with machine No. 2 up to speed, its armature and shunt field circuit remaining open as before. If the equalizing system is all right, the series field of machine No. 2 should get half the full load output of No. 1 (assuming that the machines are of the same power). This should give the same voltage to machine No. 2 as was found in the first instance. As a rule, it will be found that it does not do so, especially with large machines.

It is very often difficult to determine whether troubles in paralleling are due to the engine governors or to the electrical circuits. The determination can be made in this way in a few moment's time. Incidentally it should be remarked here that the successful paralleling of compound-wound machines does not depend entirely upon the equalizer, as is commonly supposed. The series fields must be thrown in parallel circuit with each other with negligible drop in the leads, and these leads inclu 'e the positive main as well as the equalizer. Still another common fallacy might be mentioned—the use of shunts across series field coils to reduce the compounding ratio of individual machines to that of the others in parallel with them. If the equalizing system is all right, the shunts are in parallel with all the fields and affect all of them alike. The shunts will only operate successfully when the equalizing system is bad, and real good paralleling can never be obtained with this condition.

POWER FACTOR.

A writer in one of our English contemporaries mathematically expresses the power factor as the quotient of one integral expression by the square root of the product of two other integral expressions. He then proceeds to prove by means of a mathematical analysis bristling with symbols, what should require no proof—that "if the power factor of a circuit is equal to unity, then the instantaneous value of the volts divided by the corresponding instantaneous value of the amperes is constant"; in other words, if there is no difference of phase, the power factor is unity. The remainder of the article is devoted to showing the benefit to be derived from defining the power factor as the cosine of a certain angle. The student who encounters this article, which is typical of most writings on alternating currents, would be justified in considering that this branch of electricity is entirely beyond the powers of any other than one highly versed in mathematics. While not denying that for certain purposes an analytical treatment of alternating currents which introduces the com-

plicated expressions necessarily incident to such treatment may be of value, it surely has no place in work where the aim in view is a practical one, or the instruction of students in the realities of alternating currents rather than in their sine-curve abstractions.

From these points of view the power factor need merely be considered as the ratio of the useful e. m. f. employed in a circuit, to the entire e. m. f. impressed on the circuit; this latter e. m. f. being the resultant of the useful e. m. f. and the reactive e. m. f. due to the inductance or capacity, or the inductance and capacity of the circuit. A sufficient abstration is the use of a right-angled triangle, for but little pains on the part of the student will be required to recognize the physical reason why the line representing the reactive e. m. f. is at right angles to the line representing the useful e. m. f.; why the resultant of these two lines represents the impressed e. m. f.; and, moreover, why the ratio of the useful to the resultant e. m. f. is the ratio of watts to volt-amperes; in other words, is the so-called power factor. Indeed for the explanation of all ordinary alter nating-current relations, the use of the right-angled triangle will be found sufficient. In considering reactive circuits in parallel it is true that the angle of 90 degrees may be lacking, but in this case the angles and sides for the triangle for solution or illustration may be obtained by construction from the right-angled triangles representing the relations involved, thus keeping the fundamental principles always in view. As in most such cases the oblique-angled triangle has two sides and their included angle known, its solution becomes a simple arithmetical problem if a table of cosines is available.

MULTIPLE LIGHTNING FLASHES.

We print in our correspondence columns this week a picture from a triple lightning flash forwarded by Mr. T. Reyman as bearing upon the subject of multiple lightning flashes, considered in our issue of the 28th October (pages 643 and 651). Mr. Reyman's photograph bears the impress of a true multiple flash, since the ripples in all three branches are seen to correspond each to each. This seems to be the criterion of a moving hole in the dielectric and discontinuous discharges passing through the same with very brief intermissions.

Taking Prof. Fessenden's letter of the 4th November (page 706), and Prof. Thomson's letter of the 11th November (page 738), we may consider that the fact is established that multiple flashes occasionally occur and are due to continuity in a hot-air streak or conducting path, with discontinuity in the electric discharge traversing it quite independent of the oscillatory character of that discharge, this explanation having been offered by Prof. Thomson some years ago in a particularly clear case.

It follows from this conclusion that a photographic study of such occasional multiple flashes as come within reach of the photographer should be of considerable value in determining the course and velocity of air currents in a thunderstorm. Two photographs of the same multiple flash, taken from different standpoints would be capable, theoretically, of constructing not only the entire path of the flash in tridimensional space, but also of determining the values and directions of the instantaneous wind velocities—by the ripple crests —at all points in the path. It has also transpired that dark lightning is a pseudophenomenon peculiar to photographically recorded images and capable of being accounted for by purely photochemical action in the sensitive film.

We do not think that the successive streamers in a multiple flash represent successive electrical oscillations in the main discharge. If the wind were sufficiently strong and the flash sufficiently close to the observer, then indeed successive oscillations should appear as independent streamers, just as they do in experimental high-tension spark discharges. But in the case, for example, of the multiple flash reported on the 28th October at page 651, not only are the streamers unevenly spaced, but if they were successive oscillations the frequency would only be about from, say, 7 to 15 cycles per second; and a lightning discharge ought to have a much higher frequency than this. We believe that each streamer is a separate discharge that may possibly contain many oscillations.

An interesting short paper by Walter appears in the *Annalen der Physik und Chemie,* Vol. 68, 1899, p. 776. The growth of a discharge between the point electrodes of an induction coil is studied by the aid of a rapidly moving photographic plate. It would seem that the final discharge only occurs after having been preceded by about five preliminary attempts, each of which succeeded in piercing the air a little further than its predecessor. In other words, the spark only leaps the full distance after having first bored a hole in the air—rock-drill fashion—by successive increasing attempts. If this is the real nature of discharges between needle-points in air, we might expect to find that the sparking distance was affected not only by the electromotive force, but also by the history of the rise of that electromotive force. In other words, the wave shape of an alternating e. m. f. might exert some influence upon the striking distance, assuming the same maximum e. m. f. reached in each cycle.

INSTITUTE STANDARDIZATION RULES.

In last week's Digest of Electrical Literature appear some criticisms by M. Guilbert upon the Standardization of Rules of the American Institute Electrical Engineers. These criticisms appear in *L'Eclairage Electrique* for the 21st October, 1899, pp. 96-101. The criticisms are not offered in a carping or captious spirit, but appear to us to be friendly but somewhat hypercritical. Concerning matters of terminology and phraseology, we have nothing to say, because such matters are always open to dispute. There are, however, a few matters of fact upon which we should differ with our esteemed contemporary.

Stress is laid upon the error involved by ignoring frictions in direct connected generators. M. Guilbert suggests running the machines in temporary bearings. The fact is, however, that the bearing friction of large machines as determined from temporary bearings may be quite different to that which exists in the working bearings. Exception is also taken to the estimation of temperature-elevation by allowing the same coefficient of increase in resistance (0.4 per cent.) whether the initial or room temperature be 0° C. or 30° C. While this is a valid criticism, it is clearly pointed out and taken into account by way of compensation in the Institute Rules.

Finally, M. Guilbert thinks it a mistake to rate alternators on the basis of non-inductive load, because in practice their loads are somewhat inductive. We think, however, that the Institute's position in this matter is correct. There can be no doubt that the non-inductive load is a possible load, and not a purely ideal condition. Moreover, it seems to be the only fair basis of comparison. If a purchaser applies a 1000-kw alternator to a circuit of 50 per cent. power factor and finds that he can only take from the machine about 500-kw of power, he, and not the machine, is to blame. If he specifies for a machine that will give him 1000-kw at 50 per cent. power factor he will make his requirement definite and he may get what he requires, but it will be a machine of more than 1000-kw capacity, and should be rated in accordance with its real capacity. Considering, however, how much debatable ground is covered by the Institute's Standardization Rules, it is really surprising how little of real criticism or dissent has appeared against them; and M. Guilbert's general views of them appear to be very favorable.

Mr. Glidden on European Telephony.

Mr. C. J. Glidden, the energetic president of the Erie Telephone & Telegraph Company, has just returned from a tour of telephonic inspection of the chief European cities, his companions part of the time there being Mr. John I. Sabin, of the Pacific telephone system, and Messrs. U. N. Bethell and H. L. Webb, of the New York Telephone Company. Mr. Glidden has kindly favored us with the subjoined interesting data of his trip and observations:

"We inspected the telephone plants in the cities of London, Brussels, Cologne, Hamburg, Copenhagen, Stockholm, Berlin, St. Petersburg, Moscow, Vienna and Paris. At all places every possible aid was given us to permit a thorough investigation of the telephone properties. Very little, however, could be learned to our advantage, outside of Stockholm, in Sweden, where 7 per cent. of the population are telephone subscribers.

"Limited concessions have retarded the development in Copenhagen, London, St. Petersburg and Moscow. The development of Berlin is about 3 per cent. of the population, while that of San Francisco now exceeds 5 per cent. The system covering Great Britain now operates nearly 200,000 stations, and is increasing at the rate of 40,000 per annum. London, however, is content with 25,000 subscribers. If developed equal to San Francisco, London would have 300,000 subscribers.

"The success of the telephone in Sweden can be attributed to two causes: First, popularity of the system; second, low rates. Stockholm, with a population of 250,000, has 19,000 subscribers, and the exchange is growing now faster than any in the United States, except possibly the Erie system, which will this year lead the world in the matter of development, with a net gain of at least 43,000 subscribers, an increase of 80 per cent. over the total number connected January 1, 1899.

"In July, 1895, President Sabin adopted on the Pacific coast a sliding scale of low rates, which resulted in increasing the San Francisco exchange from 5000 to 16,000 subscribers, within 2 per cent. of the Stockholm development. General Sabin cabled his assistant from Stockholm to arrange San Francisco for 25,000 subscribers. January 1, 1899, a similar system of sliding scale of low rates was adopted throughout the Erie system, the result being the wonderful growth mentioned.

"Taking into consideration the difference in the cost of labor, material, etc., the rates now in force on the Pacific Coast and throughout the Erie system are as low as the rates charged in Sweden. Therefore, a development equal to that of Sweden is only the question of how rapidly material can be obtained and the subscribers connected. The Erie system, I predict, will grow at the rate of 50,000 subscribers annually until the goal is reached. The plans already made by the Erie management will provide for this large and rapid increase of subscribers. The cost of extensions and the additions to the plant will be large, but every dollar expended I believe will not only bring a return to cover the cost of the new money, but allow a surplus to be distributed among the holders of stock representing the investment in the property to date. Therefore, the company cannot do otherwise than gradually increase its earnings as development progresses."

Activity in the Independent Telephone Field.

Interest in the telephone field at the present moment continues to centre in what the new Telephone, Telegraph & Cable Company may do, with its powerful financial backing. It is reported that this company and the Bell interests are both very busy just now buying up a lot of the "independent" exchanges, the object on one side being to form a nucleus for larger work, and on the other to keep the "independent" opposition segregated and disconnected. The chief item of news in this branch of the subject is Mr. Whitney's announcement that he is out of the fight. He said last week: "I am not at all connected with the new telephone company, and have not been at any time. I have no interest in it and do not expect to take any interest in it. My position is not based on any proposition as to the value of the enterprise or its character, but is from personal grounds, and because I am not able to enlist in any new enterprises."

Judge Thomas, of Chillicothe, O., president of the association of independent telephone exchanges, was in New York last week, and when interviewed as to possible combination, said: "If the consolidation in the new company were effected, my association would naturally come to an end. I cannot say what will take place, but I do not doubt that such a consolidation would afford great advantages to the independent companies, the company that absorbed them, and the public. In the first place, the long-distance communication would be a splendid financial investment. As the rates would be cut in half, the subscribers would far more than double, and the consolidated companies would all reap increased prosperity."

As to matters in New York City, it is understood that the People's Telephone Company has withdrawn from all relation with the promoters of the Telephone, Telegraph and Cable Company of America. It is also understood that the Federal Telephone Company has assumed practically the same attitude toward the Widener-Maloney syndicate. On the other hand, it is said that the Knickerbocker Telephone Company, of which the well-known telephonist, Mr. W. H. Eckert, is president, is daily in closer relations with that new element, and is getting ready to use its subway privilege. Meantime the People's Telephone Company has made application for the use of the subways in New York and has designated certain conduits and streets in which they desire to begin immediately the placing of wires. Of the authorized capital stock of $5,000,000 there has already been issued $280,000 par, on which $140,000 cash has been paid. Of this amount $100,000 has been expended. Notices have been sent to subscribers asking for the immediate payment of the $140,000 still due on account of this stock. Negotiations were also opened with a trust company for the underwriting of the unissued capital. The company has secured 7000 subscribers in New York, to whom will be given a preference in purchasing the new stock at par.

In addition to these two companies, and the Federal, not forgetting the United States Automatic, yet another has appeared on the scene in the Universal Telephone Company, also with the modest capital of $5,000,000, which, it is asserted, can dispense with the metallic circuit return, thus reducing the cost of construction and installation.

Reports are in circulation as to deals here and there, made by local exchanges with the Telephone, Telegraph & Cable Company. As to Boston, Mr. Z. S. Holbrook, president of the Massachusetts Telephone & Telegraph Company, and a director of the newly-formed Telephone, Telegraph & Cable Company of America, says: "At the present time the Massachusetts company has constructed conduits on Federal Street, Atlantic Avenue, Summer Street, Dorchester Avenue and on a small section of Devonshire Street. We have purchased 150 miles of poles and wire. We have between 4000 and 5000 subscribers in the city of Boston who have signed the five-year contracts. It will be remembered that it is only ten months since we secured our rights in the city of Boston, and various unavoidable delays have been occasioned. Before the snow flies in 1900 we will give the people of this city a complete telephone exchange, enabling communication with the leading business houses. Within six weeks we hope to be talking with Springfield, Worcester, Taunton, Providence, etc., over our lines. We have made applications for franchises in many other New England cities. Our relations with the Telephone, Telegraph & Cable Company of America are such that nothing whatever can interfere with the construction of a telephone plant in this city. The Telephone, Telegraph & Cable Company has offered to furnish us with whatever funds are necessary to construct our lines in Boston and other cities in its immediate vicinity. The Massachusetts Telephone Company has estimated that $5,000,000 will be immediately required. Construction work will be rushed in the spring, or just as soon as the law allows us to further open the streets. All preliminary work will be attended to during the winter. The men who have organized the Massachusetts Telephone Company will remain in complete charge of this end of the business."

It is understood that the Telephone, Telegraph & Cable Company has already taken steps to organize territorial sub-companies for its long distance work, and that the first of these will be in New Jersey. The work for the construction of the trunk lines across that state is now being pushed actively, it is said. A large amount of material will soon be required. It is also claimed by one of the new local companies in New York City that it is ordering cables this week and proposes to pull them into the subways next week. Such celerity of delivery by any of the cable manufacturers in these busy days will be rather remarkable—if true.

The New Station of the Kings County Electric Light and Power Co.

BY GEORGE T. HANCHETT.

THIS installation, the latest addition to the light and power system of the Kings County Electric Light and Power Company, illustrates the most modern phase of central station engineering. It is therefore of interest to all who have occasion to erect or operate such installations.

The station is situated on John Street, Brooklyn, and on the East River water front, being thus conveniently located for receiving coal from barges, and also with reference to distributing its power to various localities. The building is of brick, glass and iron, and its fire-proof construction is such as to practically eliminate all danger of permanent shut-down from fire. The fire which destroyed the cable station at Washington a few years ago offers a most potent reason why this feature should be given careful attention in station construction. The irrecoverable losses attendant on complete disablement of such a large station as this are so great that a large expense is justifiable to avoid a combustible structure.

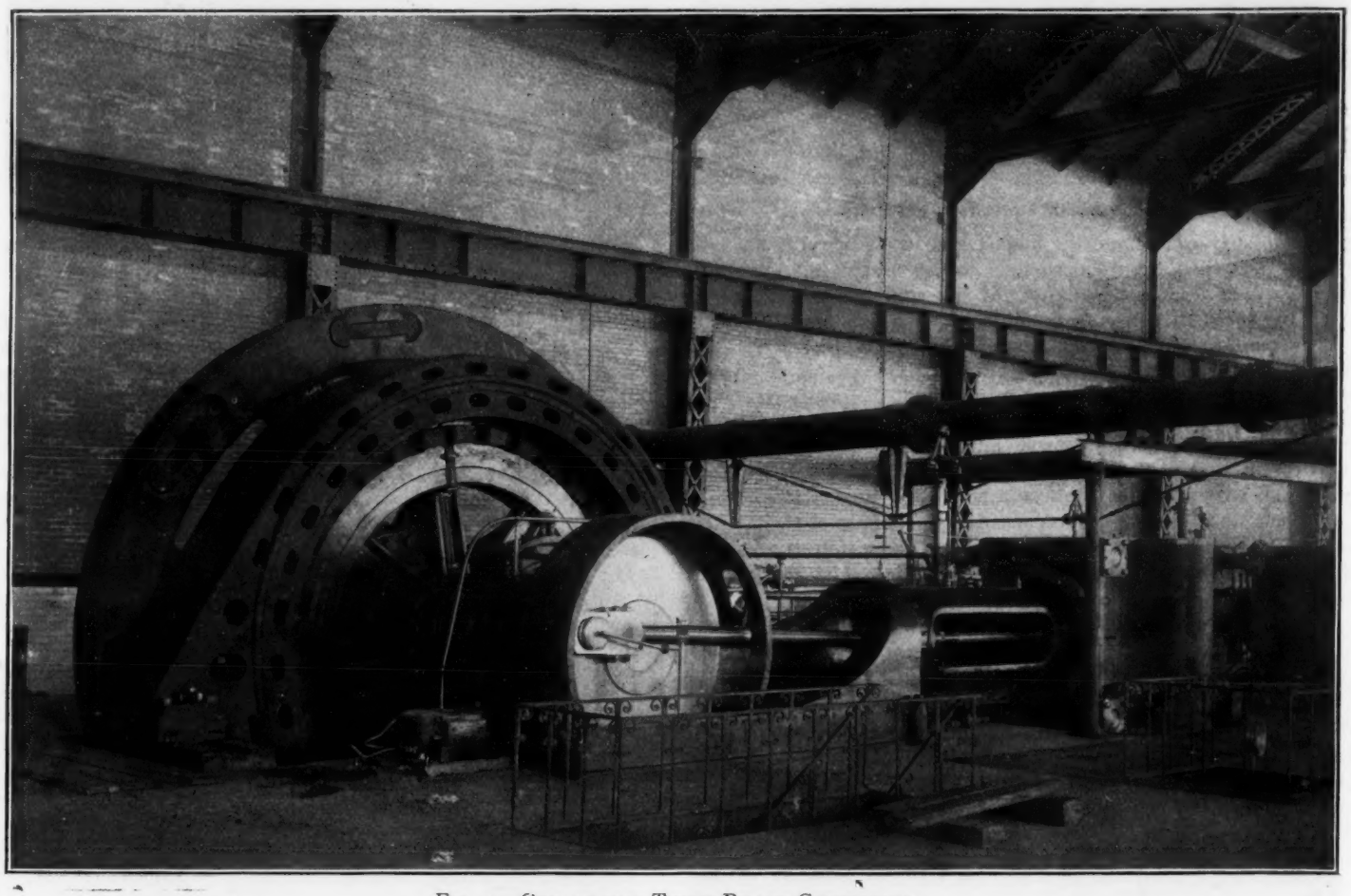


FIG. 1.—ONE OF THE THREE-PHASE GENERATORS.

The coal is received from barges landing at the station water-front, and a complete equipment of Hunt coal-handling machinery conveys it to the bunkers, from whence it is distributed to the chutes feeding the boilers The bunker, which is of steel, is located directly above the boiler-room, and its sloping sides enable every pound of coal to be withdrawn. As this bunker has a capacity of 7000 tons, it has been necessary to pay particular attention to strength in its construction.

The coal is distributed from the bunker into Hunt weighing hoppers, and thence is fed down three branching chutes to the hoppers of as many automatic stokers. There are six such sets of chutes, feeding a total of 18 furnaces. These furnaces are fitted with the American stoker, the principle and operation of which is interesting. The coal is fed into a tube in which is a very powerful broad-bladed screw and is urged forward by the rotation of the latter. At a suitable place underneath the fire, a large aperture is provided in the conveying tube which allows the coal to be forced upwards into the furnace. As the coal approaches the fire it begins to coke and its gases pass through a bed of live coals, and cannot escape, being thoroughly consumed. The coal, when it reaches the bed of the fire, is thoroughly coked, and on reaching the top of the fire becomes ash, and by the motion of the heated mass is gradually worked over to the sides of the fire and thence to the ash pits, where it is removed by automatic means.

The large screw which forms the motive power of the stoker is driven by a peculiar engine. This consists of a cylinder and piston which operates its own valves without the medium of a shaft and rotary motion, the action being similar to that of a steam pump. Attached to the piston rod is a suitable system of levers, which work a pawl engaging with a ratchet wheel mounted on the shaft driving the propelling screw. Thus each stoker is independent of its mates, and the device is thoroughly compact and simple. The engine is protected by a suitable housing, which may be seen in the illustration of the boiler fronts in Fig. 6. Bituminous coal is used, mixed with a little hard coal, to assist in burning the gases.

The feed water for these boilers is obtained from the city system. It passes through a compound heater and purifier, and thence through a Blake multi-valve pump of the ram pattern, which forces it into a duplicate system of piping leading to the boilers. The feed pipe of such a large system of boilers is, of course, proportionately large, but in this case is all of brass.

The nominal rating of these boilers, which are of the Stirling water-tube type, is 500-hp each, making a total plant capacity of 3000-hp. The boiler-room is so built that ample room is provided for additions to the installation.

The boilers have the characteristic quick-steaming qualities of the Stirling type, and the steam pressure carried is 155 pounds. Two long headers running the length of the boiler-room receive steam from the boilers, and constitute the main arteries of a duplicate system of steam piping which distributes to the four large steam units and also to the auxiliary engines and pumps. The piping is covered with Keasby & Mattison's magnabestos. Magnabestos is a compound of magnesia and asbestos, and is very effective in protecting pipes which carry steam at high temperatures. The steam pipes pass through the boiler-room wall to the engine-room, making loops and descending through the floor and distributing to the engines from below. The joints are all flanged, and the elbows are long sweeps, so as to allow a certain spring for expansion and

contraction. The long self-supporting lengths of the pipe are trussed to prevent springing.

The main engines were made by the Edward P. Allis Company, of Milwaukee, Wis. They are rated at 1000-hp each, and there are four of them. They are cross-compound and have a stroke of 48 inches, the cylinder dimensions being 23 and 46 respectively. Both cylinders are governed by a pendulum governor mounted on the low-pressure cylinder, while the high-pressure cylinder carries a governor which is designed to operate a Monarch engine stop. This precaution is very necessary, for the speed of the engine is 94

FIG. 2.—OFFICE ON SUSPENDED PLATFORM.

revolutions per minute and the diameter of its fly wheel is not less than 20 feet, making its peripheral speed nearly 6000 feet per minute. A few more revolutions of the engine would therefore bring the speed to the danger point.

These engines exhaust into separate surface condensers and the condensation is pumped therefrom by an E. P. Allis air pump and is allowed to run into the river, as it is thought to contain too much oil to be good feed water. The circulating water is salt water taken from the river, which is, of course, returned. The 40-ton fly wheel is of cast-iron, made in six segments, which are secured together by shrunk wrought-iron I-links and bolted together at the hub.

The engine is, perhaps, a representative example of the highest speed a Corliss engine can well be run at. The piston speed is 752 feet a minute, closely approaching the limit allowed by designers of such machinery.

The valve gear is the Allis-Corliss type, and a special device is

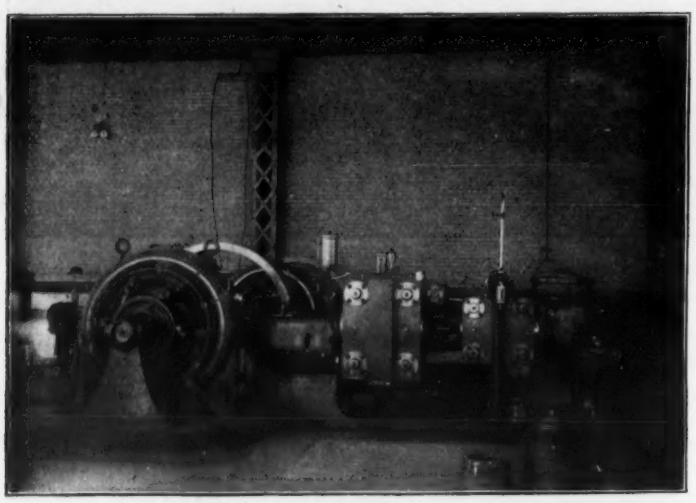


FIG. 3.—ONE OF THE SEPARATELY DRIVEN EXCITERS.

provided for lengthening the cut-off of one of the cylinders and thereby equalizing the work between them. The lubrication of the engine is accomplished for the most part by sight-feed lubricators and oil cups. A general view of one of these units is shown in Fig. 5 and gives a good idea of its arrangement, both with reference to the generator it drives and its position in the station.

The Westinghouse three-phase alternating current generators driven by these engines are of special interest. The armature is stationary and the field rotates, being supplied with current through the medium of two massive collecting rings. The excitation is at 125 volts. The frequency of the system is 25 cycles per second, and the field magnet has therefore 32 poles. These are laminated and bolted on a rim which is so massive that it forms quite a fly wheel. The field coils are wound of flat ribbon edge on, and are insulated between turns with mica, thus making a very substantial fire-proof construction, and so rigidly and closely packed as to be admirably suited for mechanical stresses to which they are subjected. The field moves and therefore the coils must be secure.

The coils are secured in place by copper wedges driven between the pole pieces. These are used partly on account of their non-

FIG. 4.—DETAILS OF POLE PIECES.

magnetic character and partly because their presence there is said to neutralize cross-currents which may arise in the armature when it is run in multiple with others.

Fig. 4 shows the construction of the pole pieces to good advantage and also the armature winding, which is interesting. The armature is wound on the star system, the common connection existing at the lower part of the frame of the machine. The coils shown in the photograph are composed of a number of turns of wire taped together, and it will be noted that the end connectors are separated from each other, having thereby an air as well as a solid insulation. The teeth of the armature are straight, being slightly notched at their tips to accommodate wood fillers, which secure the coils in place.

The machine is of 750-kw capacity and delivers three currents of 66 amperes differing in phase by 120°, and with a pressure of 6600 volts between terminals. The switchboard has not yet been installed,

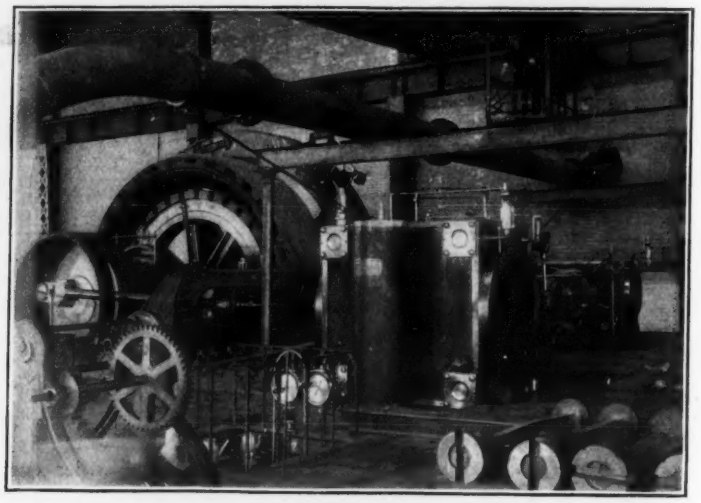


FIG. 5.—GENERAL VIEW OF ONE OF THE UNITS.

but in tracing the present output of the station it is interesting to note that it supplies about 800-hp to synchronous motors, and that it is run in multiple with another station several miles away.

The exciting current for these alternators is derived from two separately driven units, one of which is illustrated in Fig. 3. These engines are four-valve, tandem-compound engines, the valves being driven by a positive motion. They are a recent production of the Ball & Wood Company, and are of 120-hp each. They have a one-foot stroke, the cylinder dimensions being 8 inches and 17 inches respectively. The exciter units run at 275 revolutions per minute. They

are each directly connected to a compound-wound six-pole Westinghouse generator delivering direct current at 125 volts.

The excitation of the large generators is not varied automatically in any way, and such regulation as is necessary is obtained by hand. As the large machines, however, are inherently self-regulating to within a few per cent., the hand regulation will require only occasional attention. The main generator frames look very massive, but it is really surprising how little actual active metal is in the machine; less than one-half the weight of the fly-wheel armature and about one-fifth of the generator frame is active metal, the rest being merely supporting. This is necessary because the strains on the conductors and the active iron in such a large machine are so great that a most rigid support for them is essential.

The main building for the machines is ideal for such a purpose. Ample room is afforded the units, which are placed cylinder end to cylinder end in two rows. One of the longitudinal fronts is almost entirely of glass, thus providing admirable light for the station. The roof space in the eastern end of the station has been utilized for office purposes, and a sort of swinging platform is built there, (Fig. 2), on which the offices themselves are built. A powerful electric crane capable of lifting the heaviest parts of any of the machinery spans the station and traverses its entire length.

The crane is operated from a platform which moves with it, and

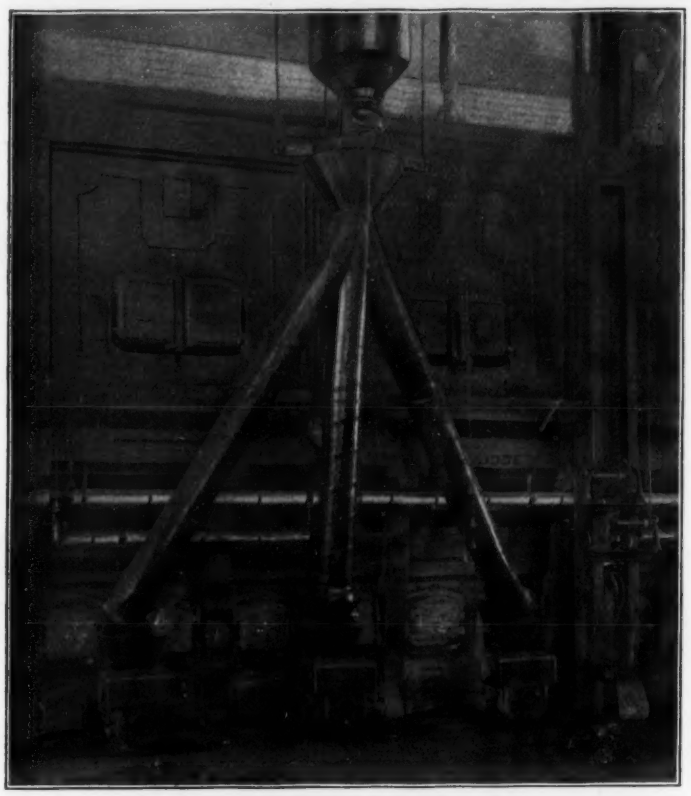


FIG. 6.—CHUTES AND MECHANICAL STOKERS.

electric motors are provided to give the span a longitudinal motion, the carriage a transverse motion, and to manipulate the hoist. At the present time it has proven a useful adjunct in the station in assembling the machinery.

One of the large units in the station is now running and another is nearly ready, and, judging from the work as far as it has progressed, it is safe to say that the plant will be one of the finest examples of central station engineering in the world.

It will be seen from the above that in the new station Brooklyn has an important and interesting addition to its already large equipment for the production of cheap current in large quantities. It should be able to produce its current very economically, and the executive staff give one confidence that such an expectation will not be disappointed. Mr. Edward Manning is the operating engineer, and Mr. Thos. E. Murray has acted as consulting engineer, while Mr. Thos. Duffy is chief engineer of construction To Mr. E. F. Peck, as representing Mr. A. M. Young, and his business associates, in connection with this important enterprise, we are indebted for many courtesies as to data, etc., in regard to the station and its equipment, as above described and illustrated in detail.

The Electric Plants of the Battleships Kearsarge and Kentucky—I.

At the annual meeting of the Society of Naval Architects and Marine Engineers, held in New York last week, Naval Constructor J. J. Woodward, U. S. N., read an admirable paper on "The Electric Plants of the Battleships Kearsarge and Kentucky." To this paper we are indebted for a description of these plants, which mark a long step forward in the utilization of electric power on warships. In the present installment the generating plant and distributing system will be considered, and in a following one the various applications of power will be taken up.

The battleships Kearsarge and Kentucky are the first vessels of the United States Navy on which the use of electricity as a motive power has been adopted to the practical exclusion of steam for the operation of the auxiliary machinery for the general service of the vessel, such as deck winches, boat cranes, ship's ventilating fans, ammunition hoists, and turret-turning machinery. The auxiliary machinery connected with the main propelling engines, such as air, feed and circulating pumps, forced-draft blowers, ash hoists, etc., are still driven by small steam engines, as well as the windlass and steering engines.

While a more extended use has been made of electrically driven auxiliaries on the Kearsarge and the Kentucky than on any other vessels of the navy up to the present time, the various types of electric machinery used on these vessels are the logical developments of similar types previously installed by the Bureau of Construction and Repair on other vessels of the navy. The turret-turning machinery, for example, may be considered a development of that which worked in so satisfactory a manner on the Brooklyn's 8-inch gun turrets during the late war with Spain; the chain ammunition hoists are the same in general principle as those used on the Puritan and many other vessels; and the extensive systems of blowers and exhausters used in the ship's ventilation are similar in character to those placed on the gunboats Nashville and Wilmington two years ago, and which to-day are giving eminently satisfactory results, both from the point of view of thorough ventilation of these vessels and ease of maintenance of the ventilation plant in an efficient condition.

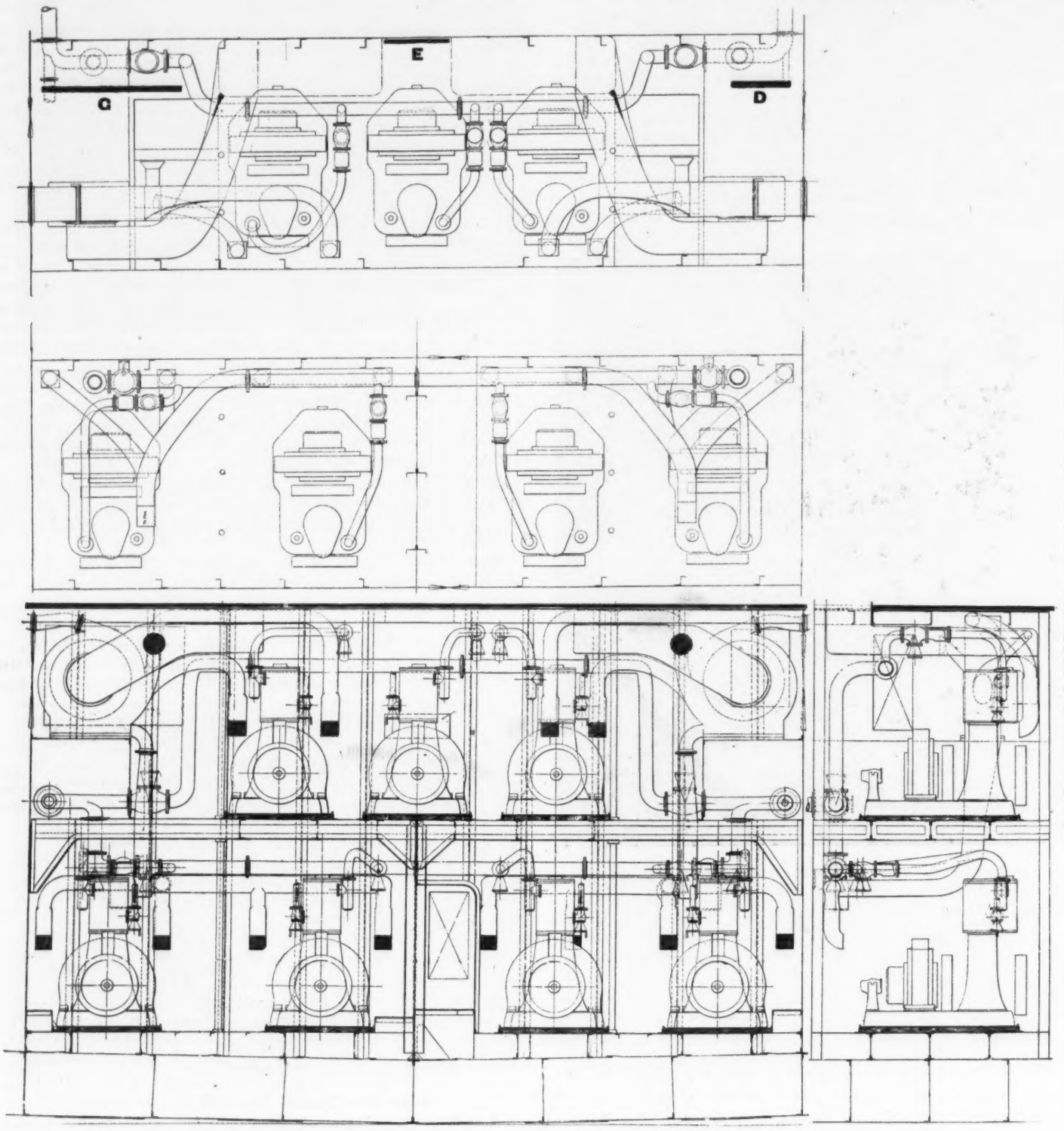
The above instances of the satisfactory working in service of electrical machinery on vessels of the navy bear favorably on the question as to maintaining in a constant state of high efficiency such an electric plant as that installed on the Kearsarge and the Kentucky. One of the most marked advantages claimed for the electric drive, namely, its efficiency in coal consumption, will increase with the size of the engines employed to drive the electric generators used, and the larger the number and collective power of the electric motors operated, the greater will be the opportunity to obtain such economy in coal consumption. On a battleship and an armored cruiser now building in this country for a foreign navy the electric drive is used for practically all auxiliary machinery, not only for the general service of the vessel, but for auxiliaries of the propelling machinery as well, with the result that the generating units are of such size as to permit of their being driven by triple expansion engines of the most efficient marine type, whose economy of steam consumption will undoubtedly approach closely that of the main propelling engines. The duty of the electric plants of the Kearsarge and the Kentucky is as follows:

1. The ship is lighted under peace and battle conditions. 2. Four searchlights are operated. 3. The Ardois signal set is operated for night signaling; also, various means of interior communication within the ship, such as battle and range order indicators, electric propelling and steering-engine telegraphs, revolution and helm-angle indicators, etc. 4. The truck lights and ship's running lights are operated, also portable diving lanterns. 5. The two turrets containing the 8-inch and 13-inch guns are rotated, the 13-inch guns elevated, ammunition hoisted for both 8-inch and 13-inch guns, rammers of 13-inch guns operated, and special ventilation provided to blow gases out of bores of 8-inch and 13-inch guns. 6. Ten endless chain ammunition hoists are operated, eight of them supplying the 5-inch broadside guns, and two supplying 6-pounder and 1-pounder guns on the upper deck. Two winch type of hoists are operated, supplying ammunition to the 6-pounder guns in the after cabins. 7. Six deck winches are operated—four winches of a simple geared type with friction drum suitable for quick hoists of moderate loads, as in coaling ship, and two winches of a compound geared type permitting either the quick-hoisting of light loads or heavy

pulls at low speeds. The simple geared winches are especially designed for use as ammunition hoists to the military tops. 8. Four boat cranes are operated, the boats being hoisted and lowered, and cranes rotated by power. 9. The ship is ventilated throughout, including the engine rooms, but excluding the firerooms, by 13 ventilating fans, of which 10 supply and 3 exhaust air for the various water-tight compartments. 10. The centering hydraulic mechanism used to control the steam distribution valve of the steering engine is automatically operated.

GENERATING SETS.

The generating plant is located between the inner wing bulkheads, occupying all the space below the protective deck. This space has a platform midway of its height, and the lower half is divided into two compartments by the centerline bulkhead and the passage between the fire rooms. The upper room contains three generating sets and the switchboards, and each of the lower rooms two sets. Fig. 1 is a plan of the upper and lower dynamo room, and Fig. 2 an elevation, looking aft.



FIGS. 1, 2 AND 3.—PLAN AND ELEVATIONS OF DYNAMO ROOMS.

There are seven six-pole 50-kw, 80-volt compound-wound generators, each driven by a tandem vertical compound engine running 310 revolutions per minute at 100 pounds steam pressure. Each generator has supported from the upper frame a connection headboard and circuit-breaker, from which all cables and field and pressure wires are led..

The engine is of the single crank, vertical, tandem, compound, double-acting, enclosed type, and has a speed of 310 revolutions per minute at full load, with 100 pounds steam pressure, and 25 inches vacuum exhaust. Fig. 4 gives a view of the engine and the generator. The range of steam pressure for this engine is between 80 and 120 pounds, but the normal as well as the most economical pressure is 100 pounds. The lowest pressure at which this engine will carry full load is 80 pounds, with 25 inches vacuum. The engine will carry an overload of 50 per cent., and may be run on a steam pressure up to 150 pounds without any trouble.

The governor consists of a heavy fly-wheel, keyed to the shaft and carrying the governor parts and the high-pressure eccentric. The

governing mechanism consists of a single fly-weight, connected to a lever carrying the pin, which operates the high-pressure valve. The motion of the fly-weight is opposed by spring attached to the pulley. By increasing or decreasing the tension on this spring the speed may be raised or lowered. The same effect will be produced by moving the spring in the slot on the fly-weight.

The system of lubricating the bearings in these engines is by forcing the lubricant under pressure to the various bearings. The base forms an oil tank to which is attached a small plunger pump, driven by an eccentric on the coupling. The oil is forced by this pump to grooves in the main bearings. A drill hole in the shaft connects this groove with the crank pin. From the crank-pin box this oil is further forced to the wrist pin through a pipe. Passages in the cross-head allow the oil to be forced from the wrist-pin box to the cross-head guide. As the oil is successively forced from one bearing to the other, it is quite important the bearings are set up close together, or the oil will escape before it has reached the last bearing. The oil after passing through the bearings is collected in the column, returned to the base and used over again. A pressure gauge is attached to the system to show the pressure on the oil. This system of lubrication is perfectly reliable in its operation, prevents hot bearings, and reduces wear to a minimum, with the least attention. It is important that the oil should be free from all foreign substances, such as small particles of waste or grit. A strainer is attached to the suction valve of pump, which may be taken out for examination or cleaning at any time while the engine is in operation. A pressure of from five to twenty pounds is maintained on the oil, and regulation of this may be made by adjusting the set screw on the relief valve.

Each generator is bolted to a cast-iron base, to which is also secured the tandem compound engine just mentioned, and to the shaft of which it is directly connected. The magnet frame is a cast-steel ring made for two pieces, bolted together by steel bolts, having machined pads to which are bolted six removable cast-steel pole pieces, which are held in position by keys. Suitable lugs are cast on the lower half of the magnet frame for bolting it to the base.

The brush mechanism consists of a movable cast-iron brush-holder yoke made in two pieces and bolted together, fitting a groove turned on the commutator end of the out-board bearing. The yoke supports six brass studs insulated by fiber bushings and washers, and cross connected by copper bus rings. Each set supports seven brush holders having carbon brushes ⅞"x1¼"x2½", the brushes being connected to the brush holders by small cables.

The field coils are wound on spools made up of malleable iron flanges, riveted to a sheet iron body. The winding is insulated from the spools by flanges made of veneer wood. The series coil is first wound on the spool, the ends of the strips being brought out to make the connections. The shunt coil is wound over the series, the ends being soldered to copper terminals provided with two screws for holding the field leads. The outer layer of wires is coated with Japan to preserve the coil from moisture.

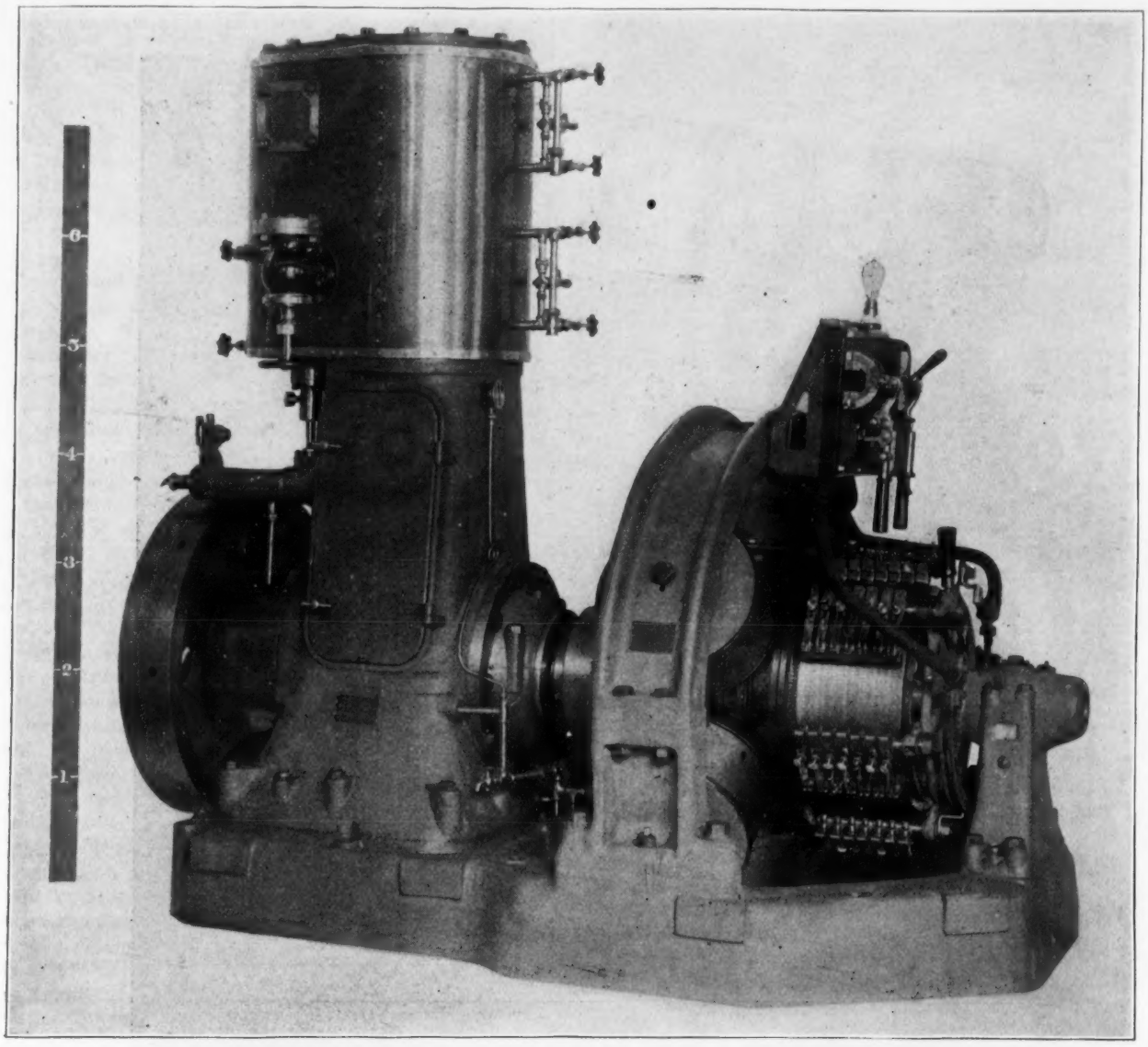


FIG. 4.—GENERATING SET.

The armature is of the drum-wound type ventilated and multiple connected. The core is made up of sheet-iron laminations provided with slots for the windings. The core is supported on a cast-iron spider, keyed to the shaft, and is ventilated by 5 ventilating ducts ⅜-inch wide. The core and slots are thoroughly insulated. The ends of the coils are connected by flexible leads to a hard drawn copper commutator, and are soldered into slots cut in the segments. The series coils are provided with German silver shunts, in order to properly adjust the compounding of the generators.

The generator head board is shown in side view in Fig. 4, and consists of a slate panel supported on iron brackets bolted to the

field ring of the generator, and containing a double-pole carbon-break circuit breaker, and a switch for short-circuiting the series coil. The positive brush-holder cable is brought up to the upper center binding post of the panel for the equalizer connection, and from this terminal a cable is taken back to one end of the series coil, and the other end of the series coil is connected to the lower center block which connects to the lower right-hand terminal of the circuit breaker. The upper right-hand terminal of the circuit breaker receives the positive cable to the generator switchboard. The negative brush-holder cable is connected to the tripping coil of the circuit breaker, which is also connected to the lower left-hand circuit-breaker terminal, the upper left-hand terminal being connected by cable to the negative side of the main switchboard.

The circuit-breaker consists of two independent single pole switches, one for each pole Between these is a single pole switch,

The main generator board is shown in Fig. 5, and consists of seven slate panels containing an ammeter, switches, and a rheostat for each generator; and one instrument panel, containing voltmeters, ground detectors, and lighting switch for the dynamo room circuit.

At the top of each of the seven generator panels is an ammeter, the shunt for which is connected in the negative side of the generator circuit. In order that each generator may be operated on either side of the three-wire system, a double-pole double-throw switch is provided, which, when thrown up, connects its generator to the positive side of the system, and when thrown down connects it to the negative side of the system.

On the back and extending the full length of these seven panels are seven busbars. The upper one is the common neutral, and one cable of all dynamos and feeders are connected to it. Below are

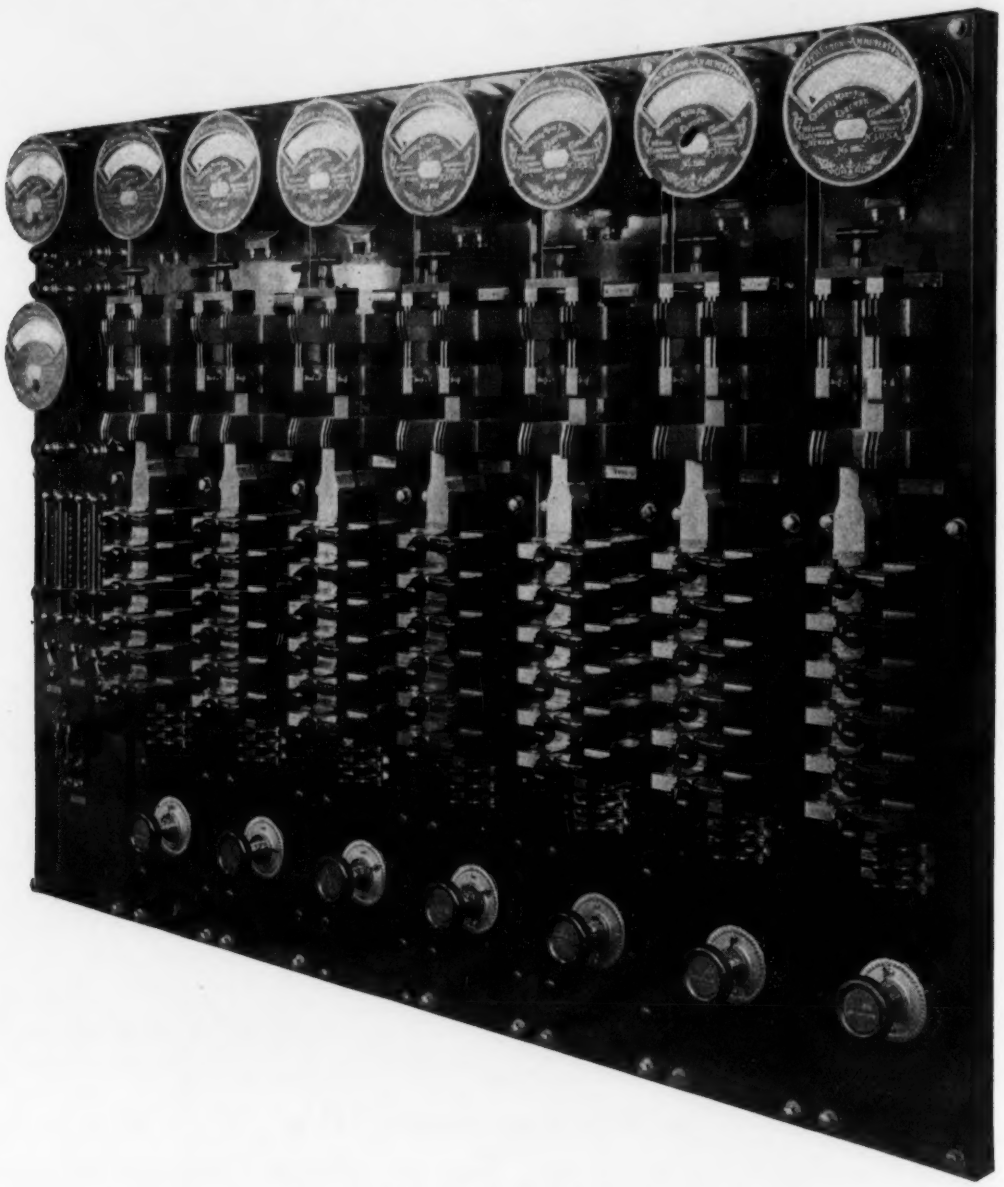


FIG. 5.—MAIN GENERATOR SWITCHBOARD.

to be closed only when the generator is operating turret-turning motors, for short-circuiting the series field. At all other times it is open. There are also on this board terminals for the field connections, and at the top a pilot lamp protected by fuses, which is not cut out when the circuit is opened.

SWITCHBOARDS.

All the dynamos are controlled by a main switchboard in the dynamo room, shown in Fig. 1 at *G*. Permanently attached to the busbars of this board are three sets of feeders which supply three main distribution boards, one of which is shown in Fig. 1 at *D* and in Fig. 6. Each of these main distribution boards supplies both light and power direct, and two of them feed auxiliary distribution boards which control only power.

the six busbars for positive lighting, positive power, positive forward turret main, positive after turret main, negative lighting, negative power. Also two small wires for use in connecting the generator field and the turret controller field wires.

Each of the six lower busbars is connected to a switch on the front of each panel, making 42 switches. These switches are ordinarily left open, except when it is desired to connect any busbar to any of the generators. Below the busbar switches are located three switches for the field circuits, the upper one being closed when the generator is used for power or lighting self-excited, the second being used for separately exciting the generator when used for turning the forward turret, and the bottom one for the after turret. From the neutral busbar are taken five cables, two of them leading to the starboard wing passage, and from there to distribution boards

Nos. 1 and 3, the other three being taken to the distribution board in the dynamo room, there being one common cable for power and lighting to each distribution board and one for turning each turret. From each of the four lighting and power busbars are taken two cables to the starboard wing passage, and from there to distribution boards Nos. 1 and 3, and from the other end of each busbar is taken one cable to distribution board No. 2 in the dynamo room. From the turret busbars are taken one cable each to the main switches of the turret on distribution board No. 2 in the dynamo room, shown in Fig. 5.

All seven equalizer switches are on one board located at a bulkhead in the centre of the upper room (*E*, Fig. 1). It consists of one plate panel 40 inches by 15 inches, which carries on its face seven single-pole double-throw switches. These engage with clips connected to two short equalizer bars which have no other connection with the outside, the positive being at the top and the negative at the bottom. It is necessary to have two equalizer bars because any dynamo may be run on either the positive or negative side of the system.

When facing the commutator of any generator, the righthand main cable is the positive, the middle the equalizer, and the left-hand the negative. Two field wires are run from each generator to the panel, where they may be connected by means of field switches, either for the self-excitation of ordinary use or separate excitation when operating turrets.

DISTRIBUTING BOARDS.

All current for power and light (except that for the illumination of the dynamo rooms) is supplied through the three main distribution board on the splinter deck, No. 1 forward, No. 2 amidships (Fig. 6), and No. 3 aft. Boards No. 1 and No. 3 feed the searchlights, and the turning motors for both turrets are fed through board No. 2.

Each of these main distribution boards is supplied by an independent set of feeders which run directly to the busbars of the main switchboard. Each of the feeders consists of five wires, one of which is the neutral for both light and power, two of the others being the positive and negative for the power and the remaining two positive and negative for the lights. The reason for thus dividing the feeder is to prevent variable loads on the power system from affecting the steadiness of the lights, but as the neutral carries but a small current the effects of having this common is inappreciable. The turret-turning motors are fed through the board amidships, No. 2, by separate feeders from the generator board. The lights are fed from these boards upon two-wire feeders and mains, and the switches controlling these individual circuits are distributed upon each side of the neutral, so as to give as nearly a balanced load as possible.

The power is supplied, either directly to the motors, or through auxiliary boards located in the turrets, and upon the main and berth decks. The motors for turret turning, exhaust fans, rammers, and elevators are run on 80 volts only. All the others are operated at 160 volts, but a switch is provided by which either 160 or 80 volts may be supplied, with the corresponding difference in speed.

The auxiliary boards, of which there are seven, are for power only, and are employed to give convenient centers of distribution, and reduce the number of wires which would be required if each motor were fed individually from the distribution boards.

The main distribution boards are of slate supported by angle-iron frames. Boards No. 1 and No. 3 are each protected by a wire mesh guard which has doors conveniently located and supplied with locks. There is on the back of each of these a feeder terminal board for the five main cables. When facing this feeder terminal board and looking toward the back of the main board, the two terminals at the right are for the lights and have fuses; the middle one is the common neutral, and has no fuse holder; the two at the left are for power, and have fuses.

There are two independent sets of three busbars, the middle bar of each set connecting to the common neutral, and the others being the positive and negative of the lights and power, respectively, except in the case of the turret-turning system, which is separately described.

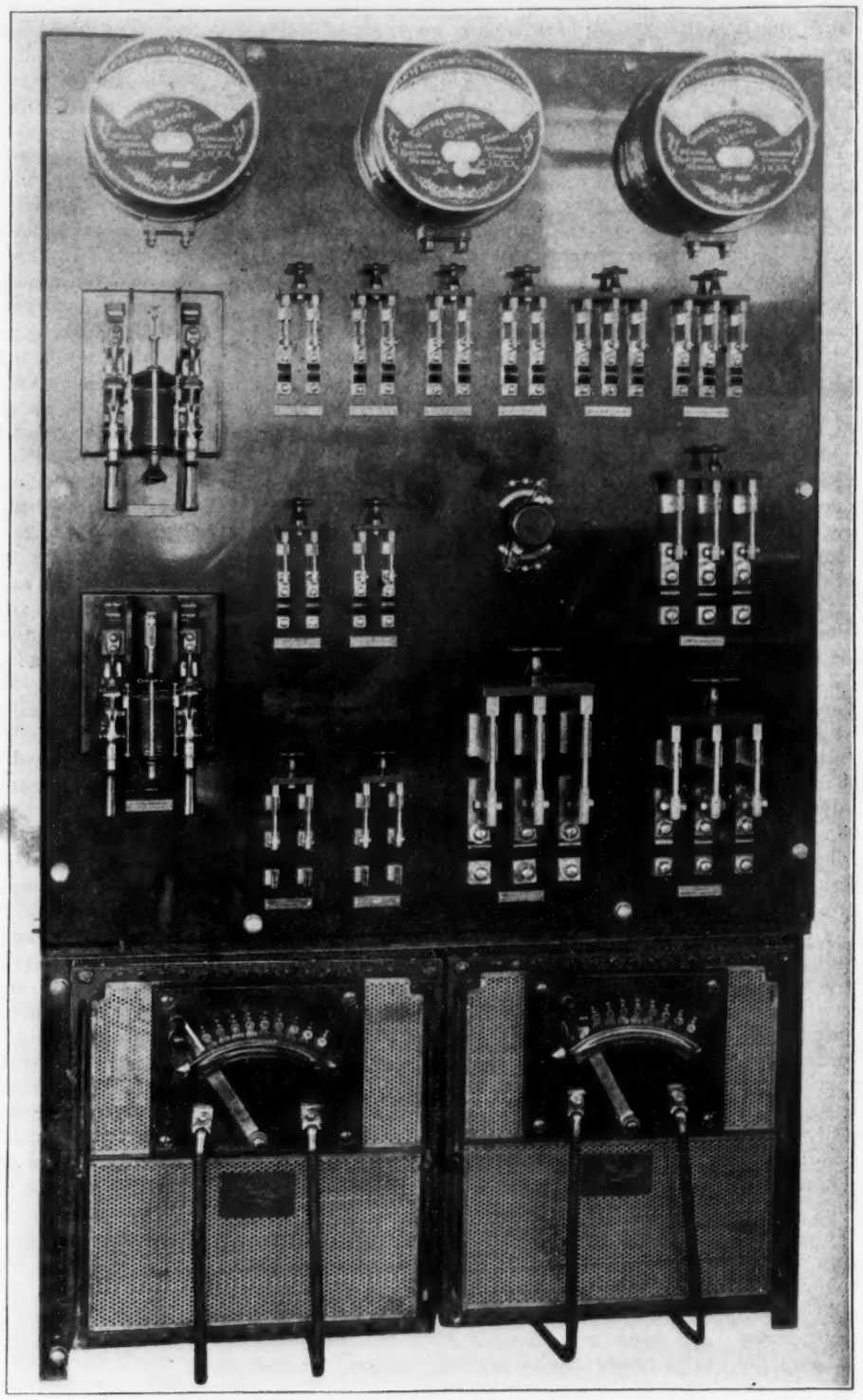


FIG. 6.—MAIN DISTRIBUTING BOARD.

DISTRIBUTION.

Every line leaving the board is protected by a fuse at the switch, except those for the searchlights, where circuit breakers are used. Each switch is marked on the front of the board with a name plate giving the circuit supplied, and on the back with the number of the circuit as shown in the diagram of connections and plans of electric light and power lines.

As an example of the distribution of the various circuits, the case will be taken of those leading from distribution board No. 1, which feeds four systems of distribution, supplying current for incandescent lights, searchlights, communication signals and power.

The incandescent lighting circuits are the battle lighting circuit for the forward turrets and handling rooms, battle circuit for the lights in the chart house, conning tower, running lights, and signal lights on both masts; non-battle circuit for lights under the fore and aft bridge; battle lighting circuit in the forward magazine and shell rooms; battle and lighting circuits supplying all lights on the protective and berth decks forward of the armor, and also the receptacles for the stay light and portables forward upon the main deck.

The searchlight circuits are for the port and starboard forward searchlights.

For communication signals a feeder runs to the communication room, for operating steam whistles and other signal devices.

For power there are six circuits, supplying current for an exhaust blower in the crew's water closet; a 5-inch ammunition hoist, starboard, on the platform deck; a 5-inch ammunition hoist, port, on the platform deck; ventilating fans in the forward blower room; an auxiliary distribution board, which feeds the forward boat cranes and deck winches on the superstructure deck, all the power in the forward 8-inch and 13-inch turrets, except that of the turning motors.

The lights are divided into two classes, battle lights and lights for normal service.

Battle lights are, in general, those which cannot be seen from the outside. They include all lights below the protective deck and such above it as are necessary for the operation of the ship in action. All battle lights above the protective deck which might be seen from the outside are controlled by individual switches, and may be extinguished, or covered so as to be invisible. These include all running and signal lights and battle lanterns.

The lamps upon the normal lighting section are such as are required for illumination, under ordinary service conditions, in addition to the battle lights. Each main is controlled by a switch, either at the switchboard or at the feeding center, by which it may be entirely cut out.

All circuits, with the exception of that for the illumination of the dynamo room, are supplied from a main distribution board. Each of the feeders for these circuits is controlled by a switch at the distribution board, and supplied ordinarily by one of the mains, the character of the feeder, whether battle or lighting, thus determining the character of the main.

The electrical energy is distributed on the three-wire system at 80 volts on each side of the neutral and 160 voles between outers. The motors and lights are so distributed and connected between the three wires, that the two sides of the system will be very nearly balanced when everything is running, and will not be excessively disturbed by any condition which may arise when only a part of the system is in operation.

When it is necessary to run more than one dynamo the three-wire system will be used; but if the load be such that one dynamo can do the work, then by the proper manipulation of switches on the main generator board the system can be run in the ordinary two-wire manner. This is done by connecting together what were previously the positive and negative busbars on the switchboard, thus allowing all the current to flow in one direction on what was the common or neutral wire of the three-wire system, and in the opposite direction on the others. This will allow any lamp or motor to be operated. The lamps will have the rated pressure of eighty volts, with full candle power; the motors will only run at half the full rated speed, but with the torque unchanged.

INSTALLATION OF CIRCUITS.

The method of installing electric light and power circuits on these ships consists of a combination of porcelain, conduit, and wooden moulding work, the exact kind employed being determined by the conditions of the individual location. In general, conductors are supported upon porcelain, except in cases where special protection is desirable; this form of installation being used in the greater part of the feeders and mains on the ship, except in the engine and fire rooms, magazines, and places exposed to the weather.

Conduit is used in the engine and fire rooms, magazines, coal bunkers, masts, and beneath the bridges. It is also employed for the protection of all wires running vertically between decks and in certain contracted or special places. Wooden moulding is used for the greater part of the branches to individual lights above the protective deck.

Open porcelain work is used in all places where there is no liability of mechanical injury or interference by irresponsible persons, as in the dynamo rooms, wing passages, officers' quarters and offices, etc. Enclosed porcelain work is employed in the crew's quarters and berthing spaces, storerooms, ammunition passages, etc. The cover for porcelain work consists of a U-shaped sheet-iron guard attached to the deck on each side of the wire. Ordinarily it is fastened to the deck above by screws, but in cases where such screws would project through the deck plating, and possibly allow water to leak below, screw studs are employed which are riveted on the upper side, and thus made water-tight, the cover being held by hexagonal brass nuts.

Wherever possible the mains have been subdivided, so that only small sections shall be dependent upon one fuse, which will open the circuit in case of trouble, without disturbing the other lights supplied by the same feeder. This should prevent the fuses on the main distribution board from opening the feeder circuit, if trouble occurs beyond one of the branch fuses, the only reason for the operation of the main fuse being the failure of the branch fuses to act, or an accident to the feeder itself.

The mains are generally run in loops fed at one point through junction boxes, so arranged that each end of any main is protected by a fuse of sufficient capacity to carry all the lights upon it. A double-pole switch is inserted at about midway between the fused ends, which, when open, separates the main into two independent parts, each protected by a set of fuses. If trouble occurs on one of these and its fuses operate, no light on the other part are extinguished. As soon as the cause of the trouble has been removed, the double-pole switch may be closed, thus feeding the entire main through the uninjured fuses of the other section until the destroyed fuses can be replaced.

An exception to this method of protection occurs in the circuits to the magazines forward and aft, where unfused feeder boxes are used, and ultimate dependence placed upon the main fuses at the distribution board.

Single lights are ordinarily protected by an independent set of fuses, but in conduit work one pair of fuses frequently supplies two lights, although care is taken that a portable and standing light shall not ordinarily be dependent upon the same set, although two portables are frequently so protected.

In the case of duplicate lights in the same location, as, for instance, in the magazine boxes, running lights etc., where the second is intended for reserve in case the first fails, both are never placed upon one fuse, although frequently each may be upon a fuse also supplying another light in a different location, i. e., one starboard and one port side light are supplied through one set of fuses, and the second starboard and port lights through another pair of fuses.

Wherever wires enter the masts above the main deck, flexible couplings, consisting of heavy rubber hose, are inserted in the conduit in order to allow the mast to move relative to the deck without injuring the protection for the wire.

In Memory of Volta.

Prof. S. P. Thompson, in a most interesting article in a recent number of the London *Electrician* on the Volta celebration and Congress, says: As we walked the streets of Como we may have smiled to see the outward and visible signs of the honors paid to the memory of Volta by those who cannot possibly understand one iota of his achievements. We may have been amused to see chocolate boxes got up in the form of "piles," or to find toy piles decorating almanacs or serving as pepper boxes, or to discover Volta's portrait woven into silk handkerchiefs, or to observe that cheap chromo-lithographs of "Volta discovering the pile" were on sale everywhere. We may have been struck with the incongruity of peasant women with bowed heads repeating their Ave Maria before Volta's tomb on the hillside, as though he had been one of the duly canonized saints in the calendar. But all these things testify—in their own several ways—to the real greatness of the man in whose honor the Congress of Como was called, and to that quality of appreciation of her great men that has never been wanting in Italy.

The Arguments in the Berliner Telephone Case.

The circumstances attending the argument on the Berliner telephone case, which came up in Boston during the past two weeks, and closed on Nov. 14, were noted in our last issue. The suits in question were brought by the American Bell Telephone Company, as already noted, against the National Telephone Manufacturing Company and the Century Telephone Company for alleged infringement of the United States patent No. 463,569, of Nov. 17, 1891, to Emile Berliner. Only two claims, first and second, were sued on, their phraseology being as follows:

"1. The method of producing in a circuit electrical undulations similar in form to sound-waves by causing the sound-waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

"2. An electric speaking telephone transmitter operated by sound-waves and consisting of a plate sensitive to said sound-waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate."

It is contended that the defendants' forms of carbon transmitters, granulated and otherwise, infringe these claims. In reply, the defendants assert that the Berliner patent is invalid because of the issue to Berliner of United States patent No. 233,969, of Nov. 2, 1880, for his receiver, as a division of the patent in suit, and other arguments are offered, much stress being laid on the prior claims of Edison as the real inventor of the modern carbon microphone. The arguments are summarized as follows by Mr. E. P. Payson, of counsel for the defendants:

First—That, not regarding Edison, but in view of the state of the art, Mr. Berliner's invention was limited to the structure depicted and described in the patent in suit and known equivalents of his metal contacts.

Second—That the Bell variable-resistance transmitter, especially the form using mercury, did disclose the idea of and mechanism for varying the external resistance by varying the intimacy and area of contact between two contiguous surfaces in the circuit by means of the pressure furnished by a diaphragm when spoken to.

Third—That there is no difference in the kind of electrical operation in the Bell mercury, the Berliner and the Edison variable-resistance transmitters; that there is no proven difference, even, in the way in which these several forms perform the same function of altering the path for the electric current; and if there is such difference in way, it is purely in degree and not cognizable under the patent law.

Fourth—That the only transmitter invented by Mr. Berliner must be regarded as a substantially useless invention for any practicable or commercial use; that it never affected the art in any way; and that there is no evidence that, if carbon had not been discovered by Mr. Edison, the Berliner metal transmitter would ever have taken the place of the magneto transmitter. No extension of Mr. Berliner's patent can be based upon any assumed possibility of what use might be made of metals by aid of further study and invention.

Fifth—That Mr. Berliner's invention of constant contact and variable pressure, if ever made by him and not derived from a knowledge of Edison's apparatus published in the *Journal of the Telegraph* and *Philadelphia Press,* was not made before August, 1877, and that no evidence in this record shows that he recognized "transition" resistance before October, 1877.

Sixth—That Mr. Edison is in point of time clearly the prior inventor of constant contact, variable pressure and transition resistance as presented by complainants in construing the Berliner patent in suit; that he was the undoubted discoverer of the commercial availability of a carbon electrode when placed in contact with either a corresponding carbon electrode or a hard metal electrode; and that commercial telephony is indebted to him for the apparatus now universally used.

Seventh—That Edison's metallic contacts anticipated everything accomplished by Berliner; that his multiple contacts carried metallic transmitters beyond anything ever reached by Berliner; that his carbon transmitters must date from previous to Jan. 20, 1877; that his February apparatus, although chiefly employing variation in area, also employed variation of the intimacy of contact and of transition resistance; that his instrument of April 1st was evidently what complainants mean by a "microphone;" that it was not "intended" to operate by the diaphragm physically compressing the hard pressed plumbago cylinder, but that its several contacts were for the purpose of more easily varying the slight pressure of the diaphragm and so the resistance, and of furnishing more than two visible surfaces between which this action might go on; and that it is clearly shown to have been a successful speech transmitter, differing from the later form of May, and the application of July 20, 1877, only in the number and arrangement of the carbon electrodes.

Eighth—That even if Mr. Edison's invention of the availability of carbon was later than Mr. Berliner's production of the apparatus shown in his patent, and later than his attempt to keep metal electrodes in constant contact, yet, in view of the art as it preceded Mr. Berliner, and in view of the fact that the carbon part of the variable-pressure transmitter was in no way implicit in such work by Mr. Berliner, but was produced by Mr. Edison, the Berliner patent in suit must be given a narrow scope, so limited as not to include either form of the defendants' transmitters. Defendants submit that this view is in every respect a reasonable view in the premises; that it leaves to Mr. Berliner the very utmost that can reasonably be claimed for him; that it concedes to Mr. Edison only that of which he was evidently the discoverer and inventor; and that it is in harmony with the general view of inventions which has been taken by the United States Supreme and Circuit Courts.

Ninth—That whatever invention Mr. Berliner may be held to have made, it was all, whether of method or of apparatus, covered by his 1880 patent No. 233,969.

Tenth—That in the remote contingency of complainants' views of the difference between varying "density" and "transition" resistance being adopted by the court, the Russian, British, French and Canadian letters patent to Berliner must be held to patent the invention of the letters patent in suit, and that their expiration has terminated that patent.

A good deal of stress is laid on Berliner's action in August, 1877, in erasing his description of double-pin structure and the inability of the single-pin device to transmit speech, and inserting a description of constant-varying contact in the single-pin device.

Against all this, the contentions of the counsel for complainant, Messrs. Betts, Fish, Robert, Swan and Richardson, are that there was radical novelty in Berliner's conception and that it was so recognized. The Bell magneto transmitter was a poor instrument for its purpose, and Berliner remedied the defect by making a new type, employing for useful purposes the bad contact "which hitherto had been a nuisance to electricians." Next, "properly speaking there is no question of infringement in these cases. If the claims are valid, infringement is obvious." It is claimed also that the Berliner metal electrode apparatus is operative, and that the allegation of inoperativeness was abandoned in the government suit. It is then asserted that the Berliner patent in suit was not rendered invalid by the Berliner patent of 1880, that there were two distinct inventions of receiver and transmitter and that the Patent Office so found. Moreover, while Berliner's apparatus might resemble Reis' and Regnault's structures, it operates differently. In no way had there been any "double patenting" nor had there been any abandonment of rights by description in an application. It is strenuously contended that Berliner was not responsible for any delay in the Patent Office, and that there had been no subterraneous effort at "prolonging the monopoly." As to the invalidating effect of Berliner's foreign patents, it is maintained that he never took any such patents on his transmitter, and cases are cited to show that the expiration of his foreign patents does not affect the term of the patent in suit. With regard to the attack on Berliner's application, it is argued that he actually invented the microphone and described it in his caveat, and that the Patent Office always found the microphone in any action taken by it upon his case. There is considerable discussion in both briefs as to what Berliner meant and arrived at in his single-pin and double-pin forms, and the complainant asserts that in describing his double-pin instrument, Berliner was obviously not concerned with an instrument in which the current is weakened and strengthened and thereby held under control—as in his single-pin form and its microphone operation. The contention is ridiculed that Bell's liquid transmitter, described in his early patent, had any microphonic features, as an anticipation, and it is asserted that it was a mere laboratory experiment, while there were many radical differences between it and Berliner's microphone. Experiments are referred to showing that there is no sensible microphonic action in such apparatus. A large amount of attention

is then given to the priority claims put forward for Mr. Edison as part of the defence, and in reply it is urged that:

First—If Berliner and Edison are to be regarded as rival inventors of the telephone, as would be the case in an interference, although no such claim has ever been made by Mr. Edison, Berliner is plainly the prior inventor; for he clearly conceived the invention in January, 1877, diligently experimented from that time on, and completed his invention in April, 1877 (if not sooner), by filing the clear description of his caveat; whereas, it is shown that Mr. Edison did not even conceive the microphonic operation until after the filing. not merely of Mr. Berliner's caveat, but of his application of June 4, 1877.

Second—Mr. Edison cannot be alleged to have made prior use of the invention before the date of Berliner's invention, for there is no proof of any successful use of a practical instrument by Mr. Edison before that time, as distinguished from a merely experimental use; and even if the practical use of any of Mr. Edison's instruments had been shown, it is clear that there would be no anticipation, because any microphonic operation which might have been present was altogether unrecognized and accidental.

In short: "Berliner was the first to conceive the microphonic principle and also the first to write a description thereof, which is found in his caveat filed in the Patent Office of the United States."

Favorable Navy Report on Wireless Telegraphy.

The United States Navy Board which made the experiments with the Marconi wireless telegraph system, as noted already in these pages, has now filed its report, as given below.

The Board consisted of Lieutenant Commander J. T. Newton, and Lieutenants J. B. Blish and F. K. Hill, and their report was submitted to Rear Admiral Bradford. These are their conclusions and recommendation:

"We respectfully submit the following findings as the result of our investigation of the Marconi system of wireless telegraphy: It is well adapted for use in squadron signaling under conditions of rain, fog, darkness and motion of speed. Wind, rain, fog and other conditions of weather do not affect the transmission through space, but dampness may reduce the range, rapidity and accuracy by impairing the insulation of the aerial wire and the instruments. Darkness has no effect. We have no data as to the effects of rolling and pitching, but excessive vibration at high speed apparently produced no bad effect on the instruments, and we believe the working of the system would be very little affected by the motion of the ship. The accuracy is good within the working ranges. Cipher and important signals may be repeated back to the sending station, if necessary, to insure absolute accuracy. When ships are close together (less than 400 yards) adjustments easily made of the instruments are necessary. The greatest distance that messages were exchanged with the station at Navesink was 16.5 miles. This distance was exceeded considerably during the yacht races, when a more efficient set of instruments was installed there. The best location of instruments would be below, well protected, in easy communication with the commanding officer. The spark of the sending coil or of a considerable leak, due to faulty insulation of the sending wire, would be sufficient to ignite an inflammable mixture of gas or other easily lighted matter, but with the direct lead (through air space, if possible) and the high insulation necessary for good work no danger of fire need be apprehended.

"When two transmitters are sending at the same time, all the receiving wires within range receive the impulses from transmitters, and the tapes, although unreadable, show unmistakably that such double sending is taking place. In every case, under a great number of varied conditions, the attempted interference was complete. Mr. Marconi, although he stated to the Board before these attempts were made that he could prevent interference, never explained how nor made any attempt to demonstrate that it could be done. Between large ships (heights of masts 130 and 140 feet) and a torpedo boat (height of mast 45 feet), across open water, signals can be read up to seven miles on the torpedo boat and eighty-five miles on the ship. Communication might be interrupted altogether when tall buildings of iron framing intervene. The rapidity is not greater than twelve words per minute for skilled operators. The shock from the sending coil of wire may be quite severe and even dangerous to a person with a weak heart. No fatal accidents have been recorded. The liability to accident from lightning has not been ascertained. The sending apparatus and wire would injuriously affect the compass if placed near it. The exact distance is not known and should be determined by experiment. The system is adapted for use on all vessels of the navy, including torpedo boats and small vessels, as patrols, scouts and despatch boats, but it is impracticable in a small boat. For landing parties the only feasible method of use would be to erect a pole on shore and then communicate with the ship. The system could be adapted to the telegraphic determination of differences of longtitude in surveying. The Board respectfully recommends that the system be given a trial in the navy."

Independent Telephony in Connecticut.

The first test case under the Connecticut legislative provision that an independent telephone company must show convenience and necessity, will be heard by Judge Thayer, of the Superior Court of New London County, in that city on Monday, November 20. The New London Automatic Telephone Company is the petitioner, and the Southern New England Telephone Company opposes. If the petition of the independent company is not granted it means practically that the Southern New England Company will have a clear field in Connecticut for its business. The petitioners organized and began on their plant just at the time when the state legislature was at work on a new telephone bill. The independent service was strongly advocated, but it is alleged that a powerful lobby and a formidable array of lawyers won the day for the New England Company.

The promoters of the New London Company alleged that they could provide a telephone service at rates lower than those in vogue at the present time. It was argued by them that the charge would be so reasonable that owners of dwellings could equip their houses with telephones as they would with bathtubs. Their opponents presented the claim that they offered a rate as low as could be consistently charged for residential service, and that this charge would be decreased from time to time, as business conditions warranted.

Annual Meeting of the National Municipal League.

The annual meeting of the National Municipal League was held last week at Columbus, O., when a number of interesting municipal topics were discussed, the attendance being excellent.

The report of the Nominating Committee was adopted, carrying with it the election of the following: President, James C. Carter, of New York; First Vice-President, Charles Richardson, Philadelphia; Second Vice-President, Samuel B. Capen, Boston; Third Vice-President, Thomas M. Strong, Portland, Ore.; Fourth Vice-President, H. Dickson Bruns, New Orleans; Fifth Vice-President, Edmund J. James, Chicago; Secretary, Clinton Rogers Woodruff, Philadelphia; Treasurer, George Burnham, Jr., Philadelphia; Executive Committee, Charles J. Bonaparte, of Baltimore, Chairman; Frank N. Hartwell, of Louisville; George W. Ochs, Chattanooga; Harry A. Garfield, Cleveland; Oliver McClintock, Pittsburg; George W. Guthrie, Pittsburg; William G. Low, Brooklyn; Dudley Tibbits, Troy; Joseph A. Miller, Providence; John A. Butler, Milwaukee; Hector McIntosh, Philadelphia.

The Executive Committee chose Milwaukee as the place of the next meeting. Boston was a prominent candidate, but the Western city won.

"The Financial Control Over Receipts and Expenditures" was the theme of A. L. Crosby, ex-Deputy Auditor of the City of Cleveland. He said: "The best 'system' of accounting ever devised is worthless unless enforced in every detail, and at the same time there are often found many ways of evading the law unless special attention is given to prevent such action; so that unless some one official shall have ample authority to order and direct the accounting in all departments, as well as the ability to properly dictate the method, and the backbone to enforce such directions and dictations, there is almost a certainty of slipping into a lax and careless manner of transacting business, especially when, as is too often

the case, the clerks are appointed on account of political prestige rather than ability to fulfil the duties of their respective positions."

"The Accounts of Municipal Industrial Enterprises" was treated by Prof. C. W. Tooke of the University of Illinois.

Walter S. Allen, of New Bedford, Mass., discussed "The Accounts of Grantees of Franchises." He maintained that by securing accurate returns from franchise companies, and by careful analysis of these returns, the relative proportion of the net profits due to each of the parties interested—the users, the investors and the whole community—can be ascertained. In this way only may reasonable charges for service, fair dividends, and a return to the community of interest on that part of the capital which it supplies, namely, the franchise, be secured.

One of the main topics of consideration was a proposed model charter for cities, in connection with which a number of important questions are raised.

American Trade Press Association.

The annual meeting and dinner of the American Trade Press Association was held at the Hardware Club, Postal Telegraph Building, New York City, on Thursday, November 16, at 6:30 p. m., when the following ticket was elected unanimously for 1900:

President, C. T. Root, *Dry Goods Economist*; First Vice-President, L. D. Gallison, *American Hatter*; Second Vice-President, F. F. Cutler, *Shoe and Leather Reporter*; Third Vice-President, L. J. Mulford, *Jewelers' Circular*; Treasurer, E. C. Brown, *Progressive Age*; Secretary, S. H. E. Redding, *Harness*; Board of Directors, T. C. Martin, ELECTRICAL WORLD AND ENGINEER; R. P. Rothwell, *Engineering and Mining Journal* (to fill the place of the two retiring directors).

After the dinner Mr. Rothwell, as retiring president, read an interesting and valuable report as to the work done, and called attention to the inadequate postal facilities, chiefly in New York. This point was also emphasized in the remarks of the incoming president, Mr. Root, whereupon a committee was appointed, as follows, to wait upon Postmaster Van Cott to co-operate with him in securing for New York City better postal facilities: C. T. Root, *Dry Goods Economist*; L. D. Gallison, *American Hatter*; J. M. Wakeman, ELECTRICAL WORLD AND ENGINEER; M. T. Richardson, *Boots and Shoes Weekly*; David Williams, *The Iron Age*.

Report on Tests of the Holland Submarine Boat.

Acting Secretary Allen, of the United States Navy, has made public the reports of the Board of Inspection and Survey and Chief Engineer John Lowe on the trials of the electric submarine boat Holland. The Board pronounced the boat a success. Chief Engineer Lowe recommends the purchase of the Holland.

The report of the Board has been referred to the Board on Construction, and will be considered by it in connection with the matter of building two submarine boats like the Holland, authority for which exists. The Holland Company has notified the Department that it will submit a proposition, which it desires transmitted to Congress, in regard to the cost of the vessel. The boat will be brought to Washington in order to give members of Congress and officials an opportunity to witness her performance.

In his report Chief Engineer Lowe gives full details of the trial of the Holland and says: "I report my belief that the Holland is a successful and veritable submarine torpedo boat, capable of making a veritable attack upon an enemy unseen and undetectable, and that therefore she is an engine of warfare of terrible potency, which the Government must necessarily adopt into its service.

"I desire to add my own opinion as to what the future policy of the Navy Department should be after inaugurating a submarine service. Instead of doing too much with one vessel, each one should be a distinct vessel of its kind, and not have combined two or more kinds in one vessel. Thus there should be submarine torpedo boats, submarine gunboats, submarine observation and despatch boats, submarine countermines and submarine channel draggers, etc., each kind complete in itself, but not combining more than one office. The object I have in mind is to keep the boats down to small dimensions for the sake of handiness, and to keep each boat as roomy and as habitable as possible for the sake of the crew."

CURRENT NEWS AND NOTES.

DARK LIGHTNING.—In the letter of Mr. Truman Hibbard, on page 748 of Nov. 11 issue, the phrase reading "seeming to *prove* the theory of dark lightning," etc., should have conveyed the opposite meaning, the word italicized having been substituted by the printer for *disprove*.

ELECTRIC TRACTION IN PARIS.—A company has been formed with a capital of 12,000,000 francs for the purpose of constructing electric railways on the left bank of the Seine. Concessions have been obtained for two lines of tramways from the Bois du Bologne, one to Vincennes and the other to Montreuil.

A MARCONI TEST.—The American Line steamer St. Paul, Capt. Jamison, from New York Nov. 8, passed Hurst Castle at 5:45 o'clock p. m. Nov. 15. Signor Marconi, who was a passenger on the St. Paul, telegraphed from her when forty-five miles outside the Needles to Totland Bay that all was well and that it was expected that the steamer would arrive here at 7 o'clock. The steamer received from land as she approached all the news of the day by the same system. Here surely is apparatus with which every seagoing steamer should be supplied.

THE AMERICAN WIRE INDUSTRY.—Mr. John W. Gates, chairman and managing director of the American Steel & Wire Company, testified before the Industrial Commission in Washington on Nov. 14, that while his company controlled a major portion of the wire product of the country it did not seem to monopolize the business. On the contrary, it encouraged other operators. He stated that Germany was the principal competitor of the United States in the manufacture of wire and its products, and gave the details of an effort he had made last summer to effect an international consolidation of wire works, taking in all those of Europe. The combination, however, failed, he said, because of the impossibility of reaching an agreement on the share of the product to be allotted to the United States manufacturing concerns.

PRIMARY BATTERY PATENTS.—Among the patents issued Nov. 14 were three relating to details of manufacture of, or new electrolytes for, primary batteries. One of these, issued to Henry Blumenberg, Jr., describes a battery compound in which bisulphate of sodium or the bisulphate of an alkali metal is used as a substitute for sulphuric acid in electric batteries, the salt being mixed with any of the usual oxidizing materials that are in the form of salts, thus forming a mixture ready to put into the battery cell together with water for making the electrolytic solution. One of the forms of the compound described consists of a mixture of bisulphate and bichromate of sodium. A patent was granted on the same date to the same inventor and to Frederick C. Overbury for an improvement on the types of batteries having a carbon electrode. The carbon is in the form of a cup and the terminal copper conductor therefor passes through a hole in the rim of the cup to the bottom, where it takes a turn at right angles and ends in the centre of the bottom, the end being zigzagged and secured by a plug of lead or similar material and protected by a resinous material over the lead plug. By this means conduction of the current through the carbon to the terminal electrode is more uniformly distributed, thus preventing injury to the conductor at the point of contact with the carbon electrode. A patent was also granted on the same date to Frederick G. Curtis on a process of making porous earthenware cups, which is described as follows: About one hundred pounds of clay is washed in water and mixed with a solution consisting of five gallons of water and one pound of hydrate of potassium, the latter serving to dissolve the excess of sulphates when any are present in the clay. An electric current of about 50 amperes at 20 volts is then passed through the clay for about five hours, the clay being stirred or mixed at intervals of about thirty minutes to permit the gases to escape therefrom. This results in the reduction of the clay from a granular to a powder paste by reason of the hydrogen being set free. After being subjected to the action of the current, the clay is again washed with water and is then ready to be molded into cups, which are baked for about one week. Cups made by this process are said to be advantageous for use in primary batteries on account of the much lower internal resistance they possess.

THE AUTOMOBILE CLUB OF GREAT BRITAIN.—This organization celebrated the second anniversary of its founding on Nov. 15, when a run was held, about 50 machines participating. It is stated that the run was a complete success as a demonstration of what serviceable, efficient vehicles automobiles have latterly become.

ELECTRIC RAILWAY BOOSTER SYSTEM.—A patent was issued to Rudolph M. Hunter on Nov. 14 for an electric railway booster system. In this system one or more boosters or motor generators are located at distant points of the line; the motor is operated from the line at that point, and a feeder from the power house connects with the generator part of the booster, the other connection of the generator passing to the line.

NEW STORAGE BATTERY.—A patent was issued Nov. 14 to Edward Baines on a storage battery paste compounded of lead oxide, sulphuric acid and finely divided charcoal. The lead oxide and sulphuric acid are first mixed to form a binder and finely divided charcoal is then thoroughly incorporated in the paste. It is stated that charcoal in finely divided form has the property of absorbing and condensing within its pores many times its volume of oxygen. One ounce of finely divided charcoal to two pounds of lead oxide is stated to give excellent results.

STREET RAILWAYS IN MICHIGAN.—According to recent statistics prepared to show the extent of the street railway business in Michigan the number of systems in the state is 19, including the three in Detroit, which are counted as one. The aggregate capital invested is $14,045,000, an average of $739,210 to each system. The largest system is in Detroit, which has $7,000,000 invested, and the smallest is in Adrian, where $20,000 is invested. The aggregate miles of rails in the state is 441, the aggregate number of cars 456, the aggregate number of employees in the operating department 1692. The monthly pay rolls aggregate $87,789. Nearly every system in the state reports that improvements are either being made or are in contemplation and will be made in the near future.

ENGINEERING EDUCATION AND EXPANSION.—In a paper read before the Society for the Promotion of Engineering Education, Prof. W. S. Aldrich, of the University of Illinois, considered the connection between engineering education and expansion. In the development of our foreign trade one of the elements of competition not to be disregarded, he said, is the strength coming from the attention paid in foreign countries to engineering and industrial education. The recent advances of the principal European countries in commercial, industrial and technical education have had far-reaching results in promoting their trade, and it behooves our country to train young men in technical and other schools who will be able to meet this element of competition.

ELECTRIC FAN MOTOR.—In a patent issued Nov. 14 to Charles R. Meston, of St. Louis, Mo., a compact design of alternating current fan motor is described. In the usual type of alternating current fan motor on the market, there are 28 polar projections, each of which is wound with two coils, making 56 coils in all. According to the present invention, 14 of these poles would have no windings, thus resulting in a saving in the work required to make connections, decreasing the cost otherwise of the motor, and enabling the diameter of the field to be reduced from 14 to 9 inches. The polar projections are alternately with and without coils. Those without coils are plain polar projections, while the projections with coils are forked. On one prong of the fork is also wound a small starting coil—the starting coils all being in series with one another and the main coils also in series with one another, as usual. In addition the patent describes improvements in other manufacturing details.

ENGLISH COMMERCIAL INTELLIGENCE DEPARTMENT.—The commercial intelligence office, a new department of the Board of Trade, which is to supply merchants and manufacturers with information as to trade and markets all over the world, has been opened in London. The office is in charge of Mr. Thomas Worthington, whose recent reports on the trade of South America attracted wide attention. The commercial intelligence office is an experiment, the object being to learn all that is to be learned about the markets and tariffs and competition and rates, and to place it at the disposal of the merchant to whom it may be of use. Besides collecting information from colonies and India in the ordinary way, the department, it is expected, will send special commissions to foreign countries as occasion requires or procure special reports by experts upon particular trades or industries, subject to the sanction of the Foreign Office. It will arrange for the exhibition of patterns and samples. All this information will be distributed, frequently free of cost, to chambers of commerce and other public bodies, and at a small cost to manufacturers, merchants and other private persons.

ELECTRIC FARMING IN GERMANY.—The Helios Company of Cologne, Germany, will begin early next year to erect a large plant in the Province of Posen, for the distribution of electricity for lighting and power purposes over an extensive agricultural district. The distributing mains will extend for a distance of 15 miles around the station. Not only is it intended to supply current for lighting purposes and operating dairy machinery, but also for driving agricultural implements, such as threshing machines, plows and chaff cutters. It is estimated that the undertaking will cost about $1,300,000. The Helios Company has already made arrangements with land owners in the district in which the plant is to be erected for the annual plowing of their land. For this purpose 40 plowing machines will have to be provided, as the work must be done, according to agreement, between July 15 and Dec. 1 every year.

GOLD CUP FOR AUTOMOBILES.—Baron Zuylen de Nyevelt, president of the Automobile Club of France, has been interviewed about the cup just offered by his organization for international competition. The Baron says the first contest will be held as near May 1 as possible, the idea being to make the date coincide with the great automobile day at the Exposition. The rules under which the cup races will be run every year have not yet been fully studied. These rules will not be determined solely by the Frenchmen, who, as they are offering the cup, are anxious not to lay themselves open to a suspicion of arranging racing conditions that would favor them against foreigners. Invitations to send delegates to Paris will soon be issued to the most representative automobile clubs of all countries—Belgium, Germany, England and the United States being held as the most important. The Baron expressed the most sanguine expectations as to the success of the scheme for which he is largely responsible. He had no doubt, he said, that automobilists all over the world would welcome the initiative of France, since France had shown them all a lead in the adoption and development of the automotor idea, and so far holds every record for speed and long distance riding with this class of vehicles.

TELEPHONE TRUNK LINE SIGNALING.—In a patent issued Nov. 14 to Thomas C. Wales, Jr., a method is described whereby trunk lines extending between different switchboards at which different sets of substation lines terminate, may be made available in common for a talking circuit and signaling circuit and in such a manner that earth connections may be used to complete the signaling circuit without unbalancing the talking circuit or without introducing disurbances therein. Until recently such trunk lines when used for signaling as well as for the transmission of speech, have had one or more ground connections at both ends of the trunk conductor attached permanently, thus producing an unbalanced condition of the talking circuit; and while in some cases this has not produced harmful results, in other localities having heavily operated electric railways, serious disturbances have resulted. The present invention contemplates the use of a permanent earth connection attached to the trunk circuit at one end only; one or more complementary ground connections are, however, provided at the other end which, normally detached, can be automatically attached to the trunk conductors when their presence becomes desirable to complete the signaling circuit; which are automatically detached while the trunk is in use as a portion of a talking circuit; which again are automatically attached for the transmission of the requisite signals at the close of a conversation; and which finally resume their normally detached condition when disconnection is fully effected—all of these several changes being, moreover, dependent upon and actuated by the normal operation of the switching devices and requiring no especial act for their accomplishment. The operation of the system requires a primary supervisory relay in the plug section, a secondary supervisory relay in the line section and magnet-actuated switches for uniting the substation lines to the trunks, as well as other special devices. The detail character of the patent does not permit of satisfactory abstract.

X-RAY EVIDENCE.—During the late election in New York City a man by the name of John X. Ray was arrested on suspicion of being a repeater. The only evidence against him was his name. When he showed that he had had that name before Röntgen made his discovery he was discharged.

THE CABLE ROUTE TO MANILA.—Rear Admiral Bradford in his annual report to the Secretary of the Navy gives an interesting account of the work of the United States collier Nero in surveying a route for a transpacific telegraph cable between Honolulu and the Philippine Islands. A submarine mountain was encountered a short distance west of the Midway Islands, which obstacle will necessitate an offset from the projected great circle route between the Midway Islands and Guam. This mountain rises from the floor of the ocean, which at that point is 2200 fathoms in depth, to within 82 fathoms of the surface. Another obstacle encountered was a submarine abyss, one of the deepest yet found. It sinks to a depth of over 4900 fathoms. Its location is about 500 miles east of Guam. The preliminary line of soundings between Honolulu and Luzon indicates that the route being surveyed will prove entirely practicable.

LUMINOUS PALACE AT THE PARIS EXPOSITION.—One of the chief popular attractions at the Paris Exposition next year will be the Luminous Palace. This building will possess considerable architectural merit, and will be attractive by day as well as by night, although its night appearance will be its chief glory. Large masses of glass in the rough are being incorporated in the walls of the building, so that the walls may be said to be practically constructed of that material. The glass is very irregular in form and is used without any previous preparation or finishing. It is of a green color, the shade varying according to the thickness of the glass. The main entrance to the building is reached by two flights of wide winding stairs made entirely of glass cut into slabs of the proper length and thickness, and of the same color as that used in the walls. Glass is being used in the construction of this building wherever it is possible to use it. The interior of the building will be brilliantly lighted at night by electric light, which shining through the transparent walls will present a beautiful and fairy-like scene as viewed from the outside. The glass in the walls being of irregular shape and thickness will have the effect of breaking the light into rays of different intensities and shades of color which will produce a charming effect. The stairways will glow with a soft diffused light, the glass used in their construction having a flat, ground surface. An electric fountain is being erected in front of the main entrance, glass also being used very plentifully in its construction. The Luminous Palace is on the Champ de Mars near the Eiffel Tower, and will no doubt be a centre of attraction at night.

LETTERS TO THE EDITORS.

Protection of Interior Wiring from High Potential Currents.

To the Editors of Electrical World and Engineer:

Sirs:—I note with interest the letter of Dr. Cary T. Hutchinson in your issue of November 4, criticising the article of Messrs. Reed on the "Protection of Interior Wiring from High Potential Currents."

The criticism seems to have been hastily made, and its author views the question from a preconceived set of conditions, entirely ignoring other conditions which exist in practice. An analysis of the conditions as he conceives them may be stated as (1), a ground of no resistance; (2), a low tension network of very low resistance; (3), a high tension circuit of comparatively high resistance; (4), a cross of variable resistance. These conditions fulfil his theory and may exist in practice, but they do not by any means fulfil *all* the conditions that exist. An infinite number of conditions may be considered to co-exist wherever two systems can become crossed, and the relative position of the cross with regard to the systems affected determines the exact relations resulting from the cross. When it is further considered that various systems may have widely different conditions, the assumption that the relations of all crossing systems resolve to an arbitrary standard is untenable.

In regard to the first premise, "A ground of no resistance," the resistance of a ground connection is not altogether dependent upon the conductivity of the earthing wire, but more on the resistance between the metallic conductor and the surrounding soil. A ground, therefore, varies not only with the size of ground contact, but also with the character and moisture of the soil. A multitude of grounds might become ineffective after a drought. It is conditions of this character that prevent trolley systems from having a ground of no resistance, even with their extended network of rails in contact with the earth and additional grounds placed thereon. In some cases it may be possible to effectively ground a low tension system by earthing to a system of water mains. In considering the question, however, a system of water mains or other extended networks of suitable metallic grounds cannot be counted upon as being convenient. In applying the method of grounding universally, the obtaining of grounds which would have no assign able resistance would become almost an impossibility and the attending expense would be prohibitive. It is thought that since "the proposal to protect low pressure consumption circuits by means of permanent grounds has for its basis the establishment of a series of grounds that shall be permanent and shall be of inappreciable resistance compared with the resistance of the consumption circuit," and since the consumption circuit is assumed to be of very low resistance, it appears that grounds whose resistances are inappreciable therewith cannot be obtained in practice.

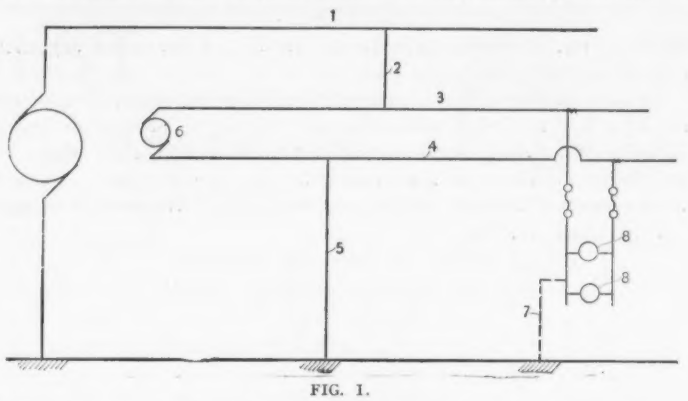


FIG. 1.

The incorrectness of Dr. Hutchinson's theory does not depend alone upon whether grounds of no resistance can be obtained in practice. It is further assumed by him that the low-tension circuit is always of very low resistance as compared to the crossing high-tension circuit, and that, therefore, when *C D* is of low resistance the fall of potential always takes place over the high tension circuit *C A B H*. In other words, a 500-volt trolley system, irrespective of its capacity or size of conductors, has its voltage lowered at the point of crossing to that of the low tension system. It is hardly necessary to say that this is not a universal condition. In many instances the high tension circuit will have a lower resistance than the low tension circuit, the relative resistance will not depend entirely upon the size of the conductors, but also upon the relative position of the cross. To further illustrate, Fig. 3 shows a trolley circuit crossed with a low tension system. Let *G H* be considered to have no resistance and *C D* to have no resistance; the fall of potential will then be divided according to the resistances of the circuits *C A B H* and *D E F G*. This trolley circuit may be of low resistance and the low tension of comparatively high resistance, or vice versa. Suppose they are the same, then the relative resistance and consequent fall of potential on the circuits depends entirely upon the location of the cross *C D*. If *C D* is close to generator Y, the

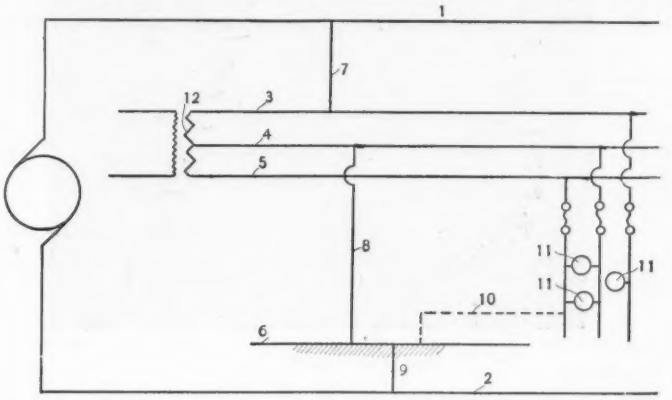


FIG. 2.

fall of potential will be almost entirely across the low tension circuit *D E F G*. If *C D* be close to generator X, the main fall of potential will be over circuit *C A B H*. The potential may, therefore, vary above the earth from its normal to the potential of the

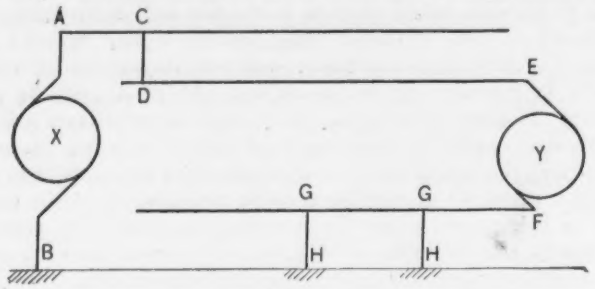


FIG. 3.

crossing circuit above its normal. In Fig. 2 the same argument may be applied as in Figs. 1 and 3.

In view of the above it is reaffirmed that the grounding of one leg of a low tension system does not afford the protection desired in all cases. And when the low tension circuit rises above its normal to the earth, it is necessary to cut out the house circuits to insure safety therein.

WARREN B. REED.

NEW ORLEANS, LA.

A Multiple Lightning Flash.

To the Editors of Electrical World and Engineer.

Sirs:—I read in your issue of Oct. 28 the very interesting article by Dr. Kennelly on multiple flash lightning, and note that in your editorial in the same issue you state that such examples of lightning are very rare, and also that it is a popular impression that lightning never strikes twice in the same place. In this connection the following account of a lightning flash may be of some interest.

About 9 o'clock on the night of July 20 last a storm approached

A MULTIPLE LIGHTNING FLASH.

from the west, and passed almost overhead. While it was raging I took a camera to the roof of the house in which I live, and holding it toward the sky and pointing to the east, the cap was scarcely off when there was a flash of lightning, which had the appearance of a single streak. A loud crash followed and immediately after indications of a fire could be seen on the horizon. The next day I read in the newspapers that lightning had struck an oil tank in this direction. I enclose herewith a print developed from the above negative.

NEW YORK, N. Y. THEO. REYMAN.

Professional Degrees.

To the Editors of Electrical World and Engineer:

Sirs:—I think the whole matter of engineering degrees needs to be gone over and a uniform degree adopted. When that is done it does not make much difference what degree is used. Personally, I am in favor of Bachelor of Engineering either with or without the special branch added. If the M. E., C. E. or E. E. were universally recognized as the degree to be conferred at the end of a four years' course having certain minimum requirements, it would be all right, and would quickly be given its true value. But, at present, it stands in some colleges for four years, in others for five years and in still others for six years of work in the college, while by some it is conferred only for proven ability in practical work. This should, of course, be remedied, and the degree made as unmistakable in meaning as M. D.

As to the questions by your correspondent, Mr. Rimanoczy, I should answer:

1. No. Use the B. E. for an undergraduate degree.

2. The degree should only be granted for well proven ability without regard to time.

3. Yes. The thesis may well be descriptive of some work which proves the ability to design or to superintend construction.

4. I think that the profession, with the present confusion in degrees, do not pay much attention to any degree. What they ask from a man in search of work is a recommendation from instructors or former employers, showing his ability and value. There is so great a diversity among the men holding the same degree from the same college that a degree can never be an index of the value of a man to an employer.

5. The M. D. degree has been so long in use that its meaning is well established. I do not think a newly graduated M. D. is any more proficient than a M. E. or C. E. at the same stage of development. At the same time, the initials M. E. are used by many men, justly entitled to it, who have not had an engineering college course. The like practice cannot legally be followed by one in the medical field, even though he may be a proficient doctor. Therefore I favor, for an undergraduate degree, one which cannot be misunderstood. Then, let the professional degree stand for successful practical ability and the M. S., M. M. E. or M. E. E. stand for post graduate work inside college walls.

ARTHUR L. RICE.

PRATT INSTITUTE, BROOKLYN, N. Y.

To the Editors of Electrical World and Engineer:

Sirs:—With reference to Mr. Rimanoczy's inquiries as to the use of the terms C. E., M. E. and E. E. as first degrees, I would be glad to call attention to the following points:

Out of twenty-four of the most important schools giving engineering courses fifteen give the B. S. degree, one the B. A., five the degree of E. E. and two of M. E. for the course in Electrical Engineering. One important school that has no electrical course, gives the degree of C. E. Thus about two-thirds give the general degree and one-third the engineering degree, but on account of the importance of several of the institutions giving the latter, a comparison of the number of graduates receiving the two degrees would give a ratio much nearer unity. The matter is further complicated by the fact that eleven of the schools giving the B. S. degree give E. E. as a second degree, either for work at the school or for practical work outside. There being thus no such predominance of one plan over the other as should determine which course to pursue, it becomes necessary to discuss the question on its merits only, and here the following points should be taken into account.

While the name engineer perhaps ought to imply greater attainment than a first degree represents, the fact is that in common use it has no such definite implication, so that its use as a convenient and expressive title to indicate the completion of an engineering course, does not make unreasonable claims for the ability of the recent graduate to fill important positions. On the other hand, the fact that in Cornell, where either the B. S. or the M. E. degree has been open to the graduate in Electrical Engineering, the former is never taken, shows that the occasional use by less qualified persons of the title engineer, does not seriously diminish the value of the engineering degree in the eyes of the men that receive it. M. E. further is much more accurately descriptive of the work accomplished than is B. S., which implies the training of the scientist, a training which, while excellent in its place, is not the best for an engineer. A graduate of an important institution which uses the S. B. degree recently said to me that he had been obliged to have his cards printed with S. B. after his name and "Mechanical

Engineer" under it, in order to show both that he had received a college training and was an engineer.

Were it practicable to get concerted action from the more important technical schools, it is possible that a more desirable condition of things might be brought about. For instance, it might be well to abandon the first degrees at present given, and for all to adopt some such degree as Bachelor of Engineering, a combination, however, which is objected to on account of its hybrid character. The M. E. degree might then be uniformly given as a second degree. Again, if it were possible, there would certainly be much to say in favor of withholding the first degree till after the candidate had proved himself in practical work, and then giving the M. E. The giving of the M. E. or any other degree as an advanced degree except for work, the greater part of which is done at the university, seems to me objectionable because so subject to abuse.

As to theses as a part of a college course, they must be considered in the light of their relative educational value, and this depends much on the way in which they are conducted. If degrees are to be given for work outside the university, it would seem that theses would be very useful both as an incentive to the student to carry on investigation, and as an indication of his fitness for the degree.

Finally, after all is said and done, the name of the degree that a man takes with him from college plays so little part in his after life that the question cannot be said to be one of great importance.

F. C. CALDWELL.
OHIO STATE UNIVERSITY, COLUMBUS, OHIO.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Rotary Converters.—FUJITA; NAKAMARA; TACHIHARA.—The June 15 issue gives the concluding parts of an article on armature reactions, compound winding of the field, and the starting of a polyphase converter, by Fujita. In the issues of June and August, Nakamara discusses this article and questions whether the current in certain armature windings can be expressed by the equation $i = I \sin(\vartheta - \theta)$, or whether the reaction in the single-phase rotary can be expressed by $(\sqrt{2} - 1)\, m\, C \div \pi$, as given by Fujita; he substantiates his claims mathematically. In the August issue the discussion is decided by Tachihara, who concludes that there has been a misunderstanding of the notation of the equation by both parties. He agrees with Nakamara in the second point, referring to Steinmetz's paper read at the Cornell University three years ago.—*Elec. Friend.* (Japan), June 15, Aug. 15.

Low Voltage Dynamos.—EDGCUMBE.—Some remarks concerning the communication of Gibbings, noticed in the Digest Nov. 18. Instead of compounding the machines, as proposed, he prefers to increase the air-gap density by slightly reducing the polar arc, and to compound the exciter instead of the generator. There is some difficulty with the commutators from excessive heating due to too high peripheral speed. He thinks that for this reason Siemens & Halske now frequently use a separate commutator of smaller diameter.—*Lond. Elec.,* Nov. 3.

Determining the Output of Dynamos.—ADAMS.—Practical rules for determining the normal voltage and the current of a dynamo or motor when for any reason they are not known. The normal current may be found from the area of the brush contact by allowing about 30 amperes per sq. in. of surface contact for carbon brushes, and 100 for copper-gauze brushes or laminated brushes; this refers to the contact area of either the positive or negative brushes. The current may also be found from the resistance of the armature windings, calculating the current from the allowable heating at the rate of one watt per sq. in. of outside armature surface. Another method is to allow 2000 amperes per sq. in. cross-section of the armature wire. The normal voltage may be found from the resistance of the shunt windings in ohms, the voltage being calculated from the current which produces the allowable heat, at the rate of 0.75 watt per sq. in. of coil surface exposed to the open air.—*West. Elec.,* Nov. 11.

Transformers.—FELDMANN.—An illustrated description of a new type of Helios transformer, the special feature of which is the way in which the iron core is constructed. It is a rectangular frame having the coils on two opposite arms, the fourth side being dovetailed into the ends of the other two sides, enabling the coils to be separately wound and slipped on or changed.—*Elek. Zeit.,* Nov. 2.

REFERENCES.

Magnetic Flux in Slotted Armatures.—NIETHAMMER.—A very long illustrated article in which he deals analytically with the approximate distribution of the lines of magnetic induction in the air space and in the adjoining pole pieces, which is a question of interest in the calculation of the ampere windings necessary for overcoming the magnetic reluctance of the air space and also for the calculation of the losses by hysteresis and eddy currents in the pole pieces, and enables one to draw conclusions concerning the most practical form and size of the slots for a given air space. The article is theoretical in character.—*Elek. Zeit.,* Nov. 2.

Brush Rocker Details.—SCOTT.—A reprint of the illustrated article noticed in the Digest Nov. 18.—*El'ty,* Nov. 15.

LIGHTS AND LIGHTING.

Incandescent Lamp Tests.—An article giving the results of tests made by the Electric Tested Lamp Co., who supply lamps of a uniform grade to the public, and for this purpose undertake to test every individual lamp which they supply, for candle-power, watts consumed, vacuum and uniformity of the filament. In order to give information also about the life of the lamps and about the way the cost of light varies with the age of the lamp, they have undertaken a large series of life tests on practically every type of electric lamp on the market. The article gives the results of tests of six different lamps, the first four being classed as 16-cp and 200 volts, the other two as 16-cp and 100 volts. The names of the manufacturers are not given. The diagrams give the candle-power, the current in amperes, and the watts per cp for the hours of burning as abscissas. Of the four 200-volt lamps, two of English make are very bad; the third, an American lamp, is much better; the fourth, of English make, is the best, owing to the remarkable steadiness of the behavior of the filament, the curves being practically horizontal. If ten cents is the price per unit, the average cost per 100-cp hours is 4.5 cents, the maximum cost at the end of the test 6.5 cents for the first lamp; average 5.2 cents, maximum 6.7 cents for the second lamp; average 3.4 cents, maximum 3.9 cents for the third (American); average and maximum 3.76 cents for the fourth lamp, which shows the superiority of the third and fourth lamps over the first two. For one of the 100-volt lamps the average cost per 100-cp hours is 3.8 cents, the maximum cost a little more; for the other the average is 3.44 cents, maximum 3.76 cents.—Lond. *Elec. Eng.,* Nov. 3.

Incandescent Lamp Factory.—An illustrated description of the recently opened plant of the Berrenberg Electric Lamp Syndicate in England. In their process the vacuum of the glass bulb is produced by a mechanical pump, in which the parts liable to produce leakage are surrounded by a partial vacuum jacket which is maintained by another pump. The pump room, the lamp exhausting and sealing room, and the photometer room are described and illustrated. It is claimed for this lamp that the absence of the injurious residual substance in the vacuum, such as the mercury vapor from mercury pumps, enables the lamp to burn for a much longer period without blackening, which is said to increase the average efficiency enormously. Two curves show the latest achievements for a 16-cp lamp at 100 volts; during the first 100 hours the candle-power increased from 16 to 17; the watts per candle decreased from 2.5 to 2.4; between the 100th and 300th hour the candle-power and the watts per candle are constant; then the candle-power decreases gradually to 13 at the end of 1000 hours, while the watts per candle increase to 3. —Lond. *Elec.,* Nov. 3.

POWER.

Electric Motors for Workshops.—RAWORTH.—The first part of a paper on the generation and distribution of electric power for workshops. After stating the well-known advantages of the use of electricity instead of steam, figures are given for the cost of motors, the loss in them and the cost of generating electric power. The Manchester Co. supplies electric energy at 2 cents per hp-hour. He calculates that a 50,000-hp steam plant, at a cost of coal of $1.75, can furnish electric power at about one-third-cent per indicated hp-hour. In an appendix he gives a set of tables of the losses observed by different experimenters in shafting and pulleys, and also the power required for driving various tools.—Lond. *Elec., Elec. Eng., Elec. Rev., Ind. and Iron,* Nov. 3.

Power Distribution in Factories.—Some anonymous remarks on the editorial referred to in the Digest Nov. 4. Instead of using a motor for each machine, he thinks that in cases like lathes, where a number of speeds are necessary, and are easily obtained from a countershaft, it is best to group several together and drive from one motor. He believes the success of motor driving lies in the transmission through a belt, and belting, on account of its elasticity, is therefore preferable to gearing. He thinks the open type motor is far superior to the closed in many cases, as it gives less trouble, and is easier to look after.—Lond. *Elec. Rev.,* Nov. 3.

Water Power Plant in Canada.—A note stating that a company has been organized to utilize the water power of Burleigh Falls for generating electric power and transmitting it 17 miles to Peterboro, and 39 miles to Lindsay. Three 700-hp generators will be installed at the start. The minimum hydraulic power is 3000-hp.—*Can. Elec. News,* November.

REFERENCES.

Parsons Steam Turbo-Generator.—A description of this machine which has been repeatedly referred to in the Digest. An illustration shows the flexible bearings and the interior of the machine; two others show a 75-kw turbo-generator at the Hotel Cecil, in London, and a 350-kw turbo-alternator and exciter at the Metropolitan Electric Supply Co.'s stations in London.—From the Lond. *Eng.*; abstracted in *Sc. Amer. Sup.,* Nov. 18.

Water Power Station in Norway.—A note on a project to utilize the water power of the River Glommen, where 56,000-hp are available. It is intended to use at least a part of this power for manufacturing calcium carbide and for an electric power transmission to Moss.—*Elek. Zeit.,* Nov. 2.

Koriyama Transmission Plant.—A description of this plant in Japan in which three-phase currents of 11,000 volts are transmitted to silk spinning mills.—*Elec. Friend* (Japan), June 15.

TRACTION.

Recovering Energy in Accumulator Cars.—BUNET.—Some years ago (Digest, Jan. 4, 1896) Sarcia advocated recovering energy on the down-grades on the accumulator lines in Paris, and calculated what he called the coefficient of recuperation, making a comparison between the energy used on a trolley car and on an accumulator car, in favor of the latter. The present writer discusses the reasons why the system has not been introduced; the chief one is that shunt instead of the usual series motors would be necessary; he compares analytically the series motor without recovery with the shunt motor including recovery, and shows that the series motor is the better one to use. For automobiles the case is different, and with these it may be feasible to use compound motors, as there are less stops, the voltage is lower, and the speed is often lower; the series coil may therefore be used as a rule, and the shunt coil to diminish the speed and recover energy. No experiments have yet been made. —*L'Ind. Elec.,* Oct. 25.

Mountain Railway.—A note on a new form of rope railway, the ropes being stretched overhead between a succession of stations, while the cars are suspended on rollers. The car is pulled by means of an endless steel cable, driven electrically. As it is not considered safe to allow a greater distance than about 3300 feet between the supports, intermediate stations are necessary; the passengers change from the first car into the waiting car of the second section, and so on. Greater safety and one-third the cost of an ordinary line, are claimed. Nothing, however, beyond a model has yet been attempted. —Lond. *Elec. Eng.,* Nov. 3.

Odawara.—A description of this traction plant in Japan. Three-phase, 3500 volts, 25 amperes, 60-cycle machines are driven by Pelton water wheels, and the current is converted in the substation down to 500 volts direct for the trolley lines.—*Elec. Friend* (Japan), June 15.

Automobile.—HANCHETT.—A number of notes on the design and management of automobiles. The rating of an automobile motor may be arranged on some such plan as the following: first, its maximum capacity for continuous operation at a stated rise of temperature, as 80° F.; second, a guaranteed overload capacity for half an hour; third, a guaranteed overload capacity for ten minutes; fourth, the maximum momentary effort that the motor is capable of exerting without injury. Motors fail on sudden overloads at the commutator, the brushes, in the ventilation and in the insulation. For insulation he recommends using freely asbestos, mica and other incombustible substances which are now being made into very durable and suitable insulating compounds. He recommends copper gauze brushes mounted radially; if carefully stitched together to prevent fraying, and if well impregnated with lubricant, short, radial, gauze brushes prove very satisfactory. Proper attention should be given to the resistance of the controlling circuits of an automobile, which was sometimes found to be excessive. He points out the advantages of electric automobiles for fire service and of the distribution of electric hydrants, instead of hydraulic hydrants, in cities in which there are networks of electric mains; the fire engine should be provided with a light storage battery, capable of being discharged at an excessively high rate, powerful and speedy motors and a powerful motor directly connected to a suitable pump. Some hints are given showing how to learn to use an automobile. The necessity of a good storage battery indicator is pointed out; the use of a voltmeter, a hydrometer, a recording wattmeter, and a cyclometer for this purpose is discussed. Finally the cause and cure of sulphating of storage batteries is discussed; the cure is to give the batteries a very long overcharge at a very low rate. If charging rate of the battery is 20 amp. for 4 hours, it should be charged at the rate of 5 to 6 amp. for 20 hours, and it should be charged this way several times before the sulphating entirely disappears. The rule should be borne in mind that a battery should be charged once a week "till it boils," whether it is used or not.—*The Automobile,* November.

French Automobiles.—KUBICKI.—A description of some French types of automobiles, an electric cab and an electric phæton of the Jeantaud Co. being illustrated. In the last series of annual competitive tests of the Automobile Club of France, a number of automobiles of this firm took part and covered the distance of 37 miles in less than four hours, making an average time of 9.3 miles per hour, the maximum consumption of energy being about 10-kw hours. The tests were made during ten days, and the total distance covered was 3700 miles.—*Sc. Amer.,* Nov. 18.

REFERENCES.

Electric Railways in Northern Spain.—LAY.—An article, taken from a consular report, stating that within the last few months foreign enterprise has been the means of inaugurating electric traction in Madrid, Barcelona, Valencia, Bilboa and San Sebastian, and that other cities may follow. The present moment seems particularly opportune for manufacturers to come forward with tenders. Some statistical and financial data are given concerning the companies which control the tramways of Barcelona, San Sebastian and Bilboa. —*West. Elec.,* Nov. 11.

Electrical Progress in Spain.—A note stating that there are projects under consideration to install electric tramways from Madrid to Granada, and between Cadiz, San Fernando, Arsenal, Avanzadilla and Chichana, and to erect electric light stations in Barcelona and in San Gugat del Valles. Most of the existing electric light stations in Spain have been installed by German, Swiss and French firms.—Lond. *Elec. Eng.,* Nov. 3.

Steep Grade Line at Laon.—The translation in abstract, with some of the illustrations, of the article noticed in the Digest Nov. 4.—*West. Elec.,* Nov. 11.

Electrolysis of Water and Gas Pipes by Return Currents.—WYNKOOP.—A reprint of the paper noticed in the Digest Nov. 18.—*El'ty,* Nov. 15.

Automobile.—BAINVILLE.—The first part of a description of the automobiles at this year's exposition in Paris, referred to in the Digest Aug. 12, Sept. 2, 16.—*L'Elec.,* Oct. 28.

INSTALLATIONS, SYSTEMS AND APPLIANCES

Berlin.—An abstract of the annual report of the central stations for 1898. The main parts of the contract with the city, which extends to 1915, are noticed, and some statistical data are given. The energy furnished for private lighting was 2,440,690-kw hours in 1889, 9,315,129 in 1897, 10,143,377 in 1898; for public lighting 292,450 in 1889, 484,591 in 1898; for shops 69,591 in 1889, 5,833,077 in '97,

7,758,662 in '98; for tramways 257,050 in '95, 2,443,421 in '97, 10,166,652 in '98. To meet the rapidly increasing demand, two large generating central stations, some distance from the city, will be erected, each containing 3000-hp steam dynamos. The high tension current will be supplied to substations in the city, furnished with transformers and accumulators. A similar system is already in operation, the generating station being the original plant of the Berlin Electric Works.—*Zeit. fuer Beleucht.*, Oct. 30.

South Shields.—A well illustrated description of this English municipal lighting plant. There are at present four generating sets, each consisting of an engine coupled to an alterator with stationary ironclad armature, giving 2000 volts at 125 revolutions per minute. Two sets are rated at 100-kw and two at 200-kw each. Large extensions are contemplated, plans for four 1000-kw sets being prepared. Two rectifiers supply 60 arc lamps. The distribution to private consumers is carried out by means of substations of which two are in use, and five in course of construction, each containing six 30-kw transformers. The system of bookkeeping is also described and a page of the logbook is reprinted.—Lond. *Elec. Rev.*, Nov. 3.

Milan.—HOSPITALIER.—The first part of an illustrated description of the electric installation of the Edison Co., of Milan, Italy, using a water power of 17,300-hp 21 miles distant. Three-phase alternating currents are generated direct at 13,500 to 15,000 volts effective, and transmitted to Milan to the Porta Volta substation, where the voltage is reduced to 3600 volts, and to the Sainte-Radegonde substation, where the current is converted to 550 volts for tramways and to 120 and 240 volts direct current for distribution by a two and three-wire system. In the present part of the article the canal at the generating station is described.—*L'Ind. Elec.*, Oct. 25.

Saltburn.—An illustrated description of the recently erected 50-kw lighting plant in Saltburn, England. The chief point of interest is that it was thought economical to erect a gas generating plant and gas engines. There are two engines of 30 nominal hp each driving a dynamo of 100 amp at 220 volts; there is a battery of 120 chloride cells and a motor-driven booster.—Lond. *Elec.*, Nov. 3.

Cologne.—An abstract of the annual report of the plant in Cologne, Germany, for 1898. The energy used for motors is 19 per cent. of the total energy sold; in one year the number of motors increased from 73 to 122, of a total of 700-hp. The total energy was 1,187,000-kw hours.—*L'Ind. Elec.*, Oct. 25.

REFERENCES.

Edinburgh.—The first part of a long, well illustrated description of the new lighting station, referred to in the Digest Nov. 18.—Lond. *Elec. Eng.*, Nov. 3.

WIRES, WIRING AND CONDUITS.

Insulation Resistance.—CALLOW.—In a brief communication he claims to have established a record for insulation resistance, in a lighting installation of over 600 lamps, fixed in 522 different positions, and controlled by 189 different switches; the insulation resistance vouched for is 2 megohms.—Lond. *Elec. Rev.*, Nov. 3.

Underground Conduits.—SEWALL.—An illustrated paper read before the Chicago Electrical Association, describing some of the different types of underground circuits in use. He thinks Portland cement concrete is the best material for a perfect conduit, and the arch form the best form of duct, the height of each vertical side being exactly the same as the radius of the semi-circle which surmounts them. The shell of the arch should be as thin as possible, and three-sixteenths-inch is thought to be the proper thickness.—*West. Elec.*, Nov. 11.

REFERENCES.

Electric Wiring.—ANDREWS.—A reprint of the illustrated article noticed in the Digest Oct. 28.—*El'ty*, Nov. 8.

ELECTRO-PHYSICS AND MAGNETISM.

The Flow of an Electric Current.—ADDENBROOKE.—A short description of a model, exhibited at the English Physical Society, illustrating a number of the actions of the flow of an electric current. It consists "of a spiral of steel wire in the form of a closed circuit. Inside the spiral was placed a wire which was supposed to be carrying the current, and which directed the motion of the spiral. A rotational movement given to one part of the spiral was transmitted by the wire and produced a rotational movement at another part of the spiral. The resiliency of the spring represents capacity and the torque, e. m. f. Self-induction can be represented by weighting the spring." In the discussion S. P. Thompson agreed that many analogies could be worked out by the model, but gave examples showing that erroneous conclusions may be drawn by carrying the analogy too far.—Lond. *Elec., Elec. Rev., Ind. and Iron*, Nov. 3.

Resistance of Amalgams.—WILLOWS.—An account of measurements of the variation of the electric resistance of certain amalgams with change of temperature. The amalgams were heated from 150° C. up to 100° or more and then cooled down to 15°. The part of the curve showing the cooling is not identical with that showing the heating. Entirely different curves were obtained in several cases. It seems that amalgams have very inconstant resistances depending on the previous treatment. The curves are given and the probable causes of the peculiar behavior are discussed.—*Phil. Mag.*, November.

Electro-Photography.—FOMM.—A description of a device to photograph thin, smooth sections of different kinds of wood without a lens, by simple contact. The sections are covered on one side with tinfoil and on the other with a sheet of bromide paper, with the gelatine in contact with the wood. If a negatively charged metallic point is mounted at a distance of 5-cm from the paper surface an influence machine produces a good impression in about half a minute, showing clearly the cambium rings and medullary rays of the wood. What happens is that the paper is negatively charged, and the narrow layer of air between it and the wood is filled with photographically active glow light. In an abstract of this article Fournier d'Albe proposes to try this method for printing drawings, writing and type.—*Wied. Ann.*, No. 10; abstracted in Lond. *Elec.*, Nov. 3.

Discharges of Induction Coils.—JERVIS-SMITH.—A short description of the following experiment: The point conductors of the secondaries of a ten-inch coil, used with a Wehnelt break, were separated until the spark ceased to pass, only a faint brush discharge being visible. On bringing the flame of a spirit lamp near one of the point, a torrent of sparks flew off, ceasing when the flame was removed. This took place at the cathode pole; at the other there was no such result. It is thought that a slight discharge from the cathode point carries heated particles across to the other, thus forming a conducting path.—*Phil. Mag.*, November.

Ionized Air.—CHATTOCK.—An illustrated account of a series of experiments made by different methods, to investigate the phenomenon occurring when a sharp point discharges electricity through air toward a smooth metal plate. He measured the velocities of the ions into which the air is dissociated by the strong field at the point, and found that these ions are probably identical with those studied by Rutherford and Zeleny, who measured the sum and the ratio of the velocities of the positive and the negative ions in gases dissociated by Röntgen, and uranium rays. The ratio of the mass of the ion to the charge it carries, he found to be 1.9×10 to the minus 10th power C. G. S. units.—*Phil. Mag.*, November.

Cooling Device for Röntgen Tubes.—BUGUET and CHABAUD.—A description of a device similar to that of Walter, referred to in the Digest Oct. 14. They bring the water into direct contact with the anti-cathode; a wide tube of platinum is soldered directly into the glass tube, one end carrying the anti-cathode, which seals the tube hermetically at that end, the other end, which is bent upward, projecting outside the tube. In practice this device has proved very satisfactory, being capable of withstanding the discharges produced by the largest induction coils and quickest interrupters which would fuse an ordinary anti-cathode in a few seconds.—*Comptes Rendus*, Oct. 16; abstracted in Lond. *Elec.*, Nov. 3.

Röntgen Rays.—ROLLINS.—A note stating that the usual method of grounding the anode so as to prevent burning the patients, results in diminishing the amount of rays; he recommends instead, using a Tesla screen to prevent burning. The rays are also diminished when the target is not the anode itself, and is grounded.—*Elec. Rev.*, Nov. 8.

New Radio-Active Substances.—DERIERNE.—By analysis of the materials contained in pitchblende, he has isolated a substance generally resembling titanium, but possessing in addition a remarkably high radio-activity, estimated at 100,000 times that of uranium and its salts.—Lond. *Elec.*, Nov. 3.

Dispersion of Cathode Rays by Magnetic Force.—STRUTT.—An illustrated description of an experiment made to investigate the "magnetic spectrum" observed by Birkeland, which is produced when a narrow beam of cathode rays, generated by an induction coil, is deflected by a magnetic field, in which case some of the rays are deflected more than others. He shows that the formation of the "magnetic spectrum" is due to a peculiarity of the induction coil; the cathode rays produced by a battery are homogeneous.—*Phil. Mag.*, November.

Magnetic Properties of Alloys.—RICHARDSON.—An abstract of an English Physical Society paper, on an investigation of alloys of iron and aluminium. The alloys behave magnetically as though they existed of two distinct media superposed. The general roundness of the curves and their lack of abruptness near the critical point, seem to indicate that the alloys are heterogeneous in structure. The permeability decreases with rise of temperature near the critical point, until a minimum value is reached, when a further rise of temperature produces a very slight diminution, if any, in the permeability. The experiments suggest that the maximum value of the permeability for any alloy containing 10 per cent. of aluminium is reached at about 90° C. An alloy containing 18.47 per cent. of aluminium has a critical point at about 25° C., and gives no indication of temperature hysteresis. This alloy probably has a maximum permeability much below -90° C. At high temperatures there is a second maximum in the induction curve; it becomes less and less noticeable as the field is increased.—Lond. *Elec.*, Nov. 3.

Aluminium and Other Steels.—BARRETT.—A brief abstract of a Physical Society note on the electric and magnetic properties of aluminium steels and others. The most remarkable effect produced by aluminium on iron is the reduction of the hysteresis loss. The permeability of nickel steels is very much influenced by annealing. The addition of a small quantity of tungsten to iron hardly affects the maximum induction, but increases the retentivity and coercive force. The best steel for making permanent magnets is one containing 7½ per cent. of tungsten.—Lond. *Elec.*, *Elec. Rev.*, *Elec. Eng.*, *Ind. and Iron*, Nov. 3.

Change of Length of Iron Due to Magnetism.—AUSTIN.—A short abstract of a paper showing that the expansion of iron is smaller if magnetized with an alternating than with a direct current, and that this decrease becomes greater as the frequency becomes higher. There is a marked analogy between this phenomenon and the decrease in the magnetic permeability in an alternating magnetic field as the frequency is increased, a fact which has recently been established by Niethammer and Wien.—*Science*, Nov. 10.

REFERENCES.

Theory of the Power Factor.—RUSSELL.—The first part of an illustrated analytical investigation of the dependency of the power factor (defined as the ratio of the real watts to the apparent watts) on the shape of the waves of current and e. m. f., and their relative positions. He first proves that if the power factor of a circuit equals unity, the instantaneous value of the volts divided by the instantaneous amperes is constant, hence the current and e. m. f. waves are similar. In all other cases the power factor is less than unity and can be represented by the cosine of the angle of phase difference.—Lond. *Elec.*, Nov. 3.

Masses Smaller Than Atoms.—J. J. THOMSON.—A longer abstract of his British Association paper, noticed in the Digest Oct. 14.—*Sc. Amer.*, Nov. 18.

ELECTRO-CHEMISTRY AND BATTERIES.

Calculation of the E. M. F. of Cells.—TOMMASI.—He bases the calculation on the following law, which he discovered in 1882: If in the solution of a salt, the metal is replaced by another, the heat developed has a certain value for each metal, which is independent of the acid radical of the salt; this value he calls the "thermic constant" of the metal. He applies this rule to the calculation of the e. m. f. of such cells in which the chemical energy consumed is equal to the electric energy produced. A type of such a cell with two liquids is the Daniell cell, the e. m. f. of which he calculates as 1.084 volts. He also discusses cells with one liquid, such as a solution of sulphuric acid with zinc and platinum, or zinc and carbon, or zinc and copper electrodes.—*L'Elec.*, Oct. 28.

Coagulation Power of Electrolytes.—WHETHAM.—A short Physical Society paper on this property which depends in a striking manner on the valency of the metallic ion. The coagulative power of a substance is taken to be inversely proportional to the number of gram equivalents which must be added to a definite solution in order that immediate coagulation should follow. He gives a theory founded on the ionic theory for the electric nature of solutions, and finds his calculations for monovalent, bivalent and trivalent ions in agreement with the measurements of other investigators.—*Phil. Mag.*, November.

Quantitative Analysis by Electrolysis.—WINKLER.—Instead of the usual platinum cone or cylinder cathode or Oettel's platinum plate cathode with a forked shaped anode, one arm on each side of the cathode, he suggests the use of platinum gauze as cathode which, he claims, works very satisfactorily, the metal being deposited very regularly even with a strong current.—*Berichte*; abstracted briefly in *Science*, Nov. 10.

REFERENCES.

Progress in Applied Chemistry.—MCMUTRIE.—An abstract of an American Chemical Society paper on the progress made in the last year, dealing especially with the development of electrochemical methods, which have been duly noticed in the Digest.—*Sc. Amer. Sup.*, Nov. 18.

Solution Tension.—LEHFELDT.—His brief British Association paper in full, an abstract of which was noticed in the Digest Oct. 14.—*Phil. Mag.*, November.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Names for Physical Quantities.—HOSPITALIER.—An article proposing a system of naming those quantities which are defined as the quotient of two other quantities; this quotient is given the name of the dividend as a noun, qualified by the name of the divisor as an adjective. For instance, "linear mass," the quotient of a mass by a length, unit, gram per cm or kilogram per meter; "superficial mass," unit, gram per sq. cm.; "volumic mass" or density, unit, gram per cu. cm.; conversely, "massic length," unit, cm. per gram; "massic surface," unit, sq. cm. per gram; "massic volume," or "antidensity," unit, cu. cm. per gram. Of electric quantities the following are given: "massic power," unit, watt per kgr, for the comparison of motors, dynamos and accumulators; "surfacial power," unit, watt per sq. meter, for the comparison of power plants with regard to the areas of distribution; "volumic energy," unit ergs per cb. cm. for hysteresis losses; "massic energy," unit, watt-hour per kgr, for comparison of accumulators. He thinks it worth while to coin the qualifying words volumic and massic. For an analogous adjective for time he proposes "temporic." The adjective "poweric" would be used in "poweric price," measured by dollars per kw, the adjective "ergic" for accumulators in "ergic mass," measured by kgr per kw-hour.—*L'Ind. Elec.*, Oct. 25.

Units of Measurement.—MOON.—The first part of an article in which he points out that it is very unlikely that practical men will ever adopt the C. G. S. system. He proposes to use the kilogram as unit of mass, the decimeter as unit of length, and by introduction of decimal time, 1/4,000,000 of a day or 0.0216 seconds, as unit of time. Then the unit of force will be the weight of 21.85 kgr, the unit of power a kilowatt to within 1 per cent. The values of these proposed units in terms of C. G. S. units are given in a table. He advocates the proposal of Preece in 1888, to do away with the mechanical equivalent of heat and to use as unit of energy the degree of temperature in unit volume of water, which can be accomplished by taking as the degree of temperature one 198th of the centigrade degree, the mechanical equivalent of heat in the proposed units being 198 for a kilogram degree centigrade. He proposes to graduate a thermometer for ordinary purposes in 1000 new degrees starting from the absolute zero of temperature, so that the freezing point and vaporization point of water are at 54,000° and at 73,800°. He points out the advantages of such a thermometer scale for thermochemical and electrochemical calculations. The intensity of illumination should be given in power expended in light rays per unit surface, and the power of a source of light in power radiated in light.—Lond. *Elec. Rev.*, Nov. 3.

Devices for Producing Large Phase Differences.—GOERNER.—An illustrated description of some devices and their use in the Hartmann and Braun measuring instrument. In the first one the current is passed through the primary of a transformer in series with that part of the circuit where the large phase difference of over 90° between the current and the voltage at the main terminals is to be produced; that part of the circuit is also connected to the secondary of that same transformer. The relations existing are shown graphically with the supposition that the currents and fluxes are in phase, that is, that the advance in phase due to hysteresis and eddy currents, is neglected; but as this is not correct the differences of phase are somewhat dependent on the voltage. To correct for this, the arrangement shown in Fig. 1 is proposed, in which A and B are connected to the source, while the portion $a\ b$ is that in which the large phase difference is produced; the letters P and S represent the primaries and secondaries of transformers, one of the secondaries of which is short-circuited; the arrangement will explain itself; the currents in the secondary of the lower transformer and in the primary of the upper are independent of each other; by varying the ratio of the secondary loads in the two transformers, nearly complete

independence of the e. m. f. can be obtained. This applies to instruments in which there is no iron in the movable part; when there is iron, other devices are proposed in which the magnetic flux is not in phase with the current; one of these is shown in Fig. 2. The main current passes through the primaries of two transformers whose secondaries are also connected in series, but through an adjustable resistance, one of the transformers having an air gap; the great difference of phase is obtained between the magnetic flux in this air gap and the e. m. f. at the main terminals, and it can be

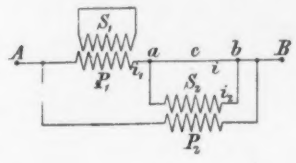


FIG. 1.

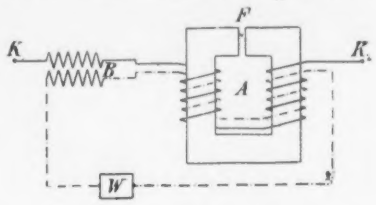


FIG. 2.

altered by changing the adjustable resistance. The relations are represented graphically. Another device consists of a horseshoe electromagnet, the cores and yoke of which are laminated but the pole pieces are not; an adjustable resistance is in series; this resistance can be so chosen that the flux between the pole pieces and the main e. m. f. differ in phase by 90° or more, as desired; this is also shown graphically. This last device is used in an alternating current wattmeter in which the rotary field causes the movable armature to revolve, at a speed proportional to the sine of the phase angle between the two alternating fields which produce the rotary field, one generated by the main current in phase with it and the other by this device; the phase difference between the main e. m. f. and the magnetic field is then made exactly 90°. The sine of the phase angle between these two fields is equal to the cosine of the angle of phase between the main current and the e. m. f., the speed being thus proportional to the power. An illustration and a mathematical theory are given.—*Elek. Zeit.*, Oct. 26.

Slippage Counter.—SEEMAN.—After describing various methods which are used, he gives an illustrated description of a convenient form of counter made by Siemens & Halske. It consists of two separate revolution counters, by which the speed of the dynamo and motor are measured simultaneously. Both instruments are applied to the shafts, but the registering does not commence until the registering wheels are thrown into action in both at exactly the same instant by means of a current passed through both of them in series; after a sufficient time the mechanisms are again thrown out of circuit by this current.—*Elek. Zeit.*, Nov. 2.

Meters on Three-Wire Circuits.—A note calling attention to the fact that when the current in the neutral wire passes through the meter, the registration cannot be relied upon if the neutral circuit is intentionally grounded, as is often the case, as part of the current of the neutral circuit may then pass through the earth around the meter instead of through it, thereby reducing the readings.—*L'Ind. Elec.*, Oct. 25.

REFERENCES.

Apparatus for Measuring Small Resistances.—ALIAMET.—An illustrated description of a Nalder instrument which is based on the potentiometer principle, the same current passing through the known and unknown resistance in series; one coil of a differential galvanometer is connected to the terminals of the unknown resistance and the other coil to the ends of a sufficient portion of the known resistance to reduce the deflection to zero.—*L'Elec.*, Oct. 28.

Wehnelt Interrupter.—VOLLER and WALTER—A reprint of the abstract noticed in the Digest Nov. 18; the original was abstracted in the Digest Aug. 19.—*Elec. Rev.*, Nov. 8.

Mercury Jet Interrupter.—LEVY.—An abstract, with illustration, of the article noticed in the Digest Nov. 4.—Lond. *Elec.*, Nov. 3.

Galvanometer for Submarine Telegraphy.—A reprint of the article noticed in the Digest Nov. 11. —*El'ty*, Nov. 8.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Long Distance Telephony.—An editorial on the development of toll lines between the principal cities of Europe. A complete list of the international lines starting from Germany and Austria, is given, together with some others. There is a new toll line now under construction between Berlin and Copenhagen, including a submarine cable of 31 miles, two wires of an existing four-wire telegraph cable being used. This will be the longest submarine telephone line in use. From an older report of Collette on tests made by the English and Dutch telephone officials, it is quoted that telephonic transmission was possible by means of two wires of a four-wire English-Dutch telegraph cable over a submarine distance of 124 miles, but the present writer questions its practicability. There is a telephone line between Paris and London, and another is projected between Belgium and England, so that it may become possible to connect Berlin and London. A number of toll lines between the main cities of Italy and between Italy and France, Switzerland and Austria, are projected. The line between Paris and Rome would be about 990 miles and would have to cross over the Alps and Appenines.—*Elek. Zeit.*, Nov. 2.

Telephone Exchange at Grand Rapids.—WARE.—A brief article on the independent exchange. There are over 3000 connections, the population being 100,000. Formerly the Bell rates were $50 and $40 for business and residence telephones; this company's rates are $20 and $30 respectively, and the competition has reduced the Bell rates to $24 and $12; the latter company has about 1700 subscribers, 65 per cent. of which are at residence rates.—*West. Elec.*, Nov. 11.

Electric Railways and Telephones.—PIERARD.—A short article on the investigations made in Switzerland where single-wire telephone wires are used almost entirely. The disturbances produced are described, and a report of the experience in Bale is given, but seems to contain nothing new. The conclusions, as might be expected, are that the telephone lines should be made double throughout.—*L'Elec.*, Oct. 28.

Japanese Submarine Cables.—YAMASAKI.—A description of the new Japanese cable ship Okinawamaru. The displacement tonnage is 2300, it is 290 ft. long, 40 ft. wide, speed 12.5 knots per hour, double screw, has a tank capacity of 20 knots of shallow sea cable 2.5 inches in diameter, 110 knots of medium depth cable 1.25 inches in diameter, and 240 knots of deep sea cable one inch in diameter, which together occupy 17,500 cu. ft. of space. He also describes cable laying.—*Elec. Friend* (Japan), Aug. 15.

REFERENCES.

Wireless Telegraphy.—NAKAMARA.—A description of the methods of signaling by ultra-violet rays, electromagnetic induction and by Hertzian waves.—*Elec. Friend* (Japan), Aug. 15.

Wireless Telegraphy on Mont Blanc.—J. and L. LECARME.—An abstract of the article noticed in the Digest Nov. 18.—Lond. *Elec.*, Nov. 3.

Simultaneous Telegraphy and Telephony.—A comparison of the Cairo system with the Van Rysselberghe, including some details of a French retardation coil.—*Elec. Friend* (Japan), June 15.

Telegraphy in Germany.—The conclusion of the article noticed in the Digest Oct. 28. To the end are added some figures and diagrams compiled by that journal showing the growth of telegraphy in Prussia and Germany from the years 1849 and 1866 respectively.—*Elek. Zeit.*, Oct. 26.

Public Telephones in Berlin.—A long illustrated French abstract of the German article noticed in the Digest Sept. 9.—*L'Eclairage Elec.*, Oct. 21.

Railroad Signals.—COLEMAN.—The first parts of a long illustrated description of the system of electropneumatic interlocking signals at the New South Terminal Station in Boston.—*Railr. Gaz.*, May 12, July 21, Nov. 10.

MISCELLANEOUS.

Electrolytic Method of Sharpening Files.—COWPER-COLES.—A description of a method of sharpening files or cutting edges by dissolving off electrically a thin and even film of the steel. The best results were obtained with a solution of ferric chloride with high current densities. Two photographs show a crosscut file before and after treatment in such a solution, a current density of 500 amperes per square foot being used for 15 minutes.—Lond. *Elec. Rev.*, Nov. 3. (Another electrolytic method was described in the Digest Feb. 11, 1893, the only difference being that a bath of nitric and sulphuric acid was used, and the file was made a part of a short-circuited battery in this liquid by being connected with a carbon plate. The gas formed is said to create bubbles which adhere to the points and protect them from being eaten away. It was said, even at that early date, that the method was used largely in France and England, where 300 to 400 files were sharpened in one bath at a time; one man could sharpen 400 files a day of ten hours.)

Electric Heating Apparatus.—An illustrated description of a French apparatus, constructed by Le Roy, who uses the remarkably

high specific resistance of crystallized silicon, which is 1333 times that of arc light carbon. The resistance itself is made up of one or more sticks of pure silicon, each of which is enclosed in a glass tube, in order to protect it from oxidation. A footwarmer for beds, now in use in the berths of the sleeping cars on the Russian Trans-Siberian Railroad, with a consumption of 35 watts per single heater, and an electric pastry oven, are described and illustrated.—From *Revue Industrielle*, translated in *Sc. Amer. Sup.*, Nov. 11.

Electrical Accidents.—Some brief extracts from the annual report of the Boston Fire Department. In one case a hole was burned entirely through a wooden partition by an incandescent lamp which had been hanging against it and had been left lighted all night. Another accident was due to flying particles of an exposed fuse which blew in a closet containing clothing. In another case a telephone pole was consumed at its base by fire caused by some crosses which led the current through a ground wire which was grounded at the base of that pole.—*Elec. Rev.*, Nov. 8.

Arc Light in Medicine.—A description of a method of treatment of skin diseases practiced by a Danish physician named Finsen, the results of which, especially in the case of lupus or tuberculosis of the skin, are said to be quite remarkable. He concentrates the chemical rays of the arc light by means of a lens made of an ammoniacal solution of copper sulphate between glass, as this absorbs the heat rays and condenses the chemical rays; sunlight is used in summer and the arc light at other times; an area of skin 1.5-cm in diameter is treated for one hour per day.—*Brit. Med. Jour.*; abstracted in *West. Elec.*, Nov. 4.

REFERENCES.

Electromagnetic Separator.—A short illustrated description of a new separator. Electromagnets are used and are demagnetized for a portion of each revolution, releasing the iron collector.—*Ind. and Iron*, Nov. 3.

Aluminium.—DITTE and MOISSAN.—A reprint of the abstracts referred to in the Digest Sept. 9.—*Elec. Rev.*, Nov. 8.

England.—An editorial on the invasion of foreign machinery into the English market and on the present condition of the manufacture of electric machinery in England.—Lond. *Elec.*, Oct. 27.

The Influence of Technical Societies in Promoting the Progress of the Arts.—POPE.—A reprint in full of the paper abstracted in ELEC. WORLD AND ENG., Oct. 14.—*Jour. Frank. Inst.*, November.

The Seventy-fifth Anniversary of the Franklin Institute from an Electrical Standpoint.—HOUSTON.—A reprint in full of the paper abstracted in the ELEC. WORLD AND ENG., Oct. 14.—*Jour. Frank. Inst.*, November.

New Books.

ELEKTRISCHER EINZELANTRIEB DER A. E. G. By Dr. O. Lasche. Berlin: Allgemeine Elektricitäts Gesellschaft. 84 folio pages, 89 illustrations.

This handsomely printed and illustrated work consists of a reprint of an article by Dr. O. Lasche on "The Distribution of Electric Power in the Works of the Allgemeine Elektricitäts Gesellschaft," which originally appeared in the *Zeitschrift des Vereines Deutscher Ingenieure*; and another article by the same writer reprinted from the same publication, on "Three-Phase Motors for Driving Machine tools." The cuts show all manner of electrically-driven tools, in every case illustrated each tool having its own motor. The book furnishes undoubtedly the best exposition thus far written on the use of three-phase currents for the distribution of power in workshops.

TABLES OF SQUARES. Containing the True Square of Every Foot and Fraction Thereof from 0 to 100 Feet, Advancing by One-sixteenth of an Inch. By John L. Hall. New York: Engineering News Publishing Company. 100 pages. Price, $2.00.

This book contains the square of every foot and fraction thereof from 0 to 100 feet, advancing by sixteenths of an inch. The book owes its inception to a similar though less extensive work by Mr. E. Buchanan. In the latter the fractional parts are expressed by the nearest four-place decimal equivalent, and then squared. This leads to errors larger than may be considered desirable. To reduce such residual errors, Mr. Hall first squares the number in complete form and then reduces to decimals, giving the values correct to the nearest sixth place. In actually carrying out the work the author discovered the existence of a series of repeating decimals which simplified the operations necessary, and made the checking of results more certain. The work seems to have been carefully done, and is well printed and bound in semi-flexible leather. It may be recommended to all who have to deal with structural iron work, or with other fields of engineering work where the squares of numbers expressed by mixed units, as feet, inches and sixteenths, may be required.

FOWLER'S MECHANICAL ENGINEERS' POCKET BOOK FOR 1900. Edited by William H. Fowler. Manchester, England: Scientific Publishing Company. 500 pages, numerous illustrations. Price, 1s. 6d.

No less than 200 pages have been added to the 1900 edition of this useful engineers' pocket book, and of this additional matter 80 pages appear in the electrical section, which now comprises 156 pages, or almost one-third of the entire contents. The largest electrical additions have been in the sections on alternating currents and electric traction, the latter section now comprising 50 pages The remarkably low price of this handbook is by no means a criterion as to its value, being accounted for by the advertising included. The various sections of the book have been compiled by competent engineers, the result being one of the most satisfactory engineers' pocket books printed.

HANDBUCH DES TELEGRAPHENDIENSTES DER EISENBAHNEN. By A. Prasch. Wien: A. Hartleben's Verlag. 207 pages, 144 illustrations. Price, 3 marks.

"The peculiar organization of the railroad service renders it necessary that the majority of its servants should be practical telegraphers and, as by reason of interruptions, etc., they are often thrown on their own resources in the manipulation of their instruments, it is also essential that these telegraphers should possess more than the simple knowledge of how to send and receive despatches," says Engineer A. Prasch in the preface to his "Handbuch des Telegraphendienstes des Eisenbahnen" (Railway Telegraphers' Handbook).

With this need of practical electrical knowledge in mind, Mr. Prasch proceeds briefly and clearly to describe the entire magnetic and electric phenomena, to give the laws governing them, and their application to electrical apparatus.

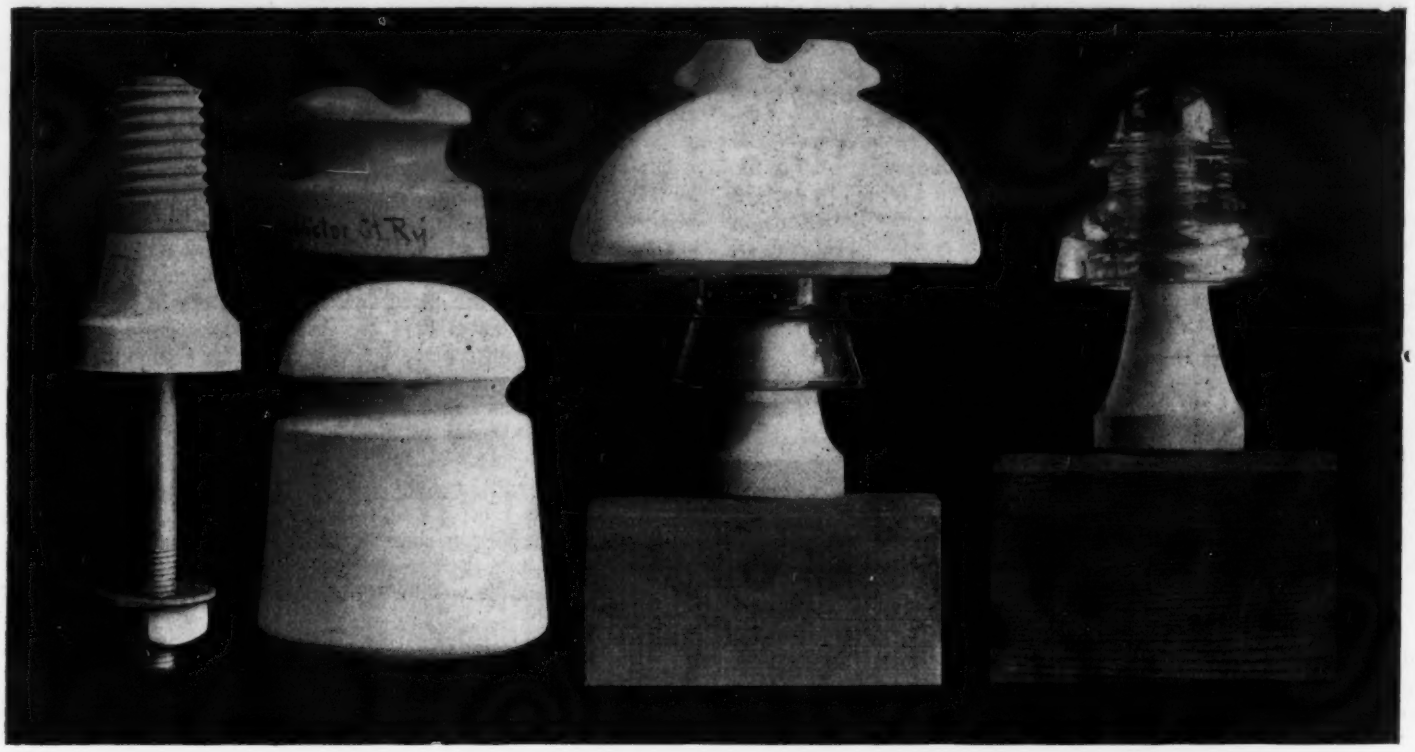
The work is divided into two parts, the second part dealing entirely with the telegraph. Beginning with the principle of the electric telegraph, Mr. Prasch introduces the student to every instrument in use in the railway telegraph system, instructs him how to make his connections, how to adjust his apparatus and care for his batteries, outlines the various "troubles" incident to telegraph lines, and gives him a few hints on wire testing.

The book is well illustrated and conveniently indexed and contains much information of interest to students of applied electricity.

ELECTRO-HORTICULTURE. Electricity on the Farm and in the Garden. By George S. Hull, M. D., Sc. D. New York: The Knickerbocker Press. 45 pages.

This little book is devoted to inculcating the use of electricity as a stimulating agent in the growth of plants and vegetables. Its writer appears to be a better chemist than electrician. We are ready to endorse his chemistry and accept his bacteriology, but his electricity we must beg his pardon for partly refusing to accept. It would seem that the author does not set forth any theories as absolutely his own, and merely gives utterance, so to speak, to facts and theories that have been enunciated by others; but assuming on this view of the case that we have no quarrel with Dr. Hull himself, our objection lies at the root of his miscellaneous collection of doubtful electrical facts and theories. It is asserted, for example, that arc lamps stimulate the growth of plant life within the immediate influence of their rays, and also that electric currents supplied through the soil in which the roots of plants are imbedded stimulate the growth of the said plants. To these proposals we would give assent on the basis of physical laws, although we are skeptical at present as to whether either electric illumination or electric earth currents can be made to pay. When it comes to *geomagnetifers*, however, which are apparently nothing more than small lightning rods set into the ground of a cultivated field, with a network of bare metal wires connected thereto and pervading the field, we confess that we do not believe a word of the glowing tribute which the writer attaches to the system. It is stated that wonderful results have been reached in France with "geomagnetifers," and if this is true, our ignorance of the facts counts as nothing, while our incredulity is of no importance. But we will only believe this geomagnetifer story when abundant evidence is furnished of a reliable nature.

We are pleased to learn that electricity has been found to favorably affect the growth of wheat, rye, barley, oats, beets, parsnips, potatoes, radishes, celery, leeks, kidney beans, raspberries and strawberries, while carrots, rutabagas, turnips, cabbages and tobacco have been more or less injured by the electric treatment. In this case, the grower of carrots, rutabagas, turnips and tobacco would be able to bring suit against trolley companies for injuring their crops by leakage return currents through the ground, while the trolley companies could exact revenue from the growers of the wheat, rye, barley, etc., for the stimulating influence of the return current. We mention this as an interesting fact for the trolley systems to observe.



NEW TYPES OF INSULATORS.

Pole Line Insulators.

The accompanying illustration shows several new types of pole line insulators made by Fred M. Locke, Victor, N. Y. The top insulator in the second row is designed for heavy street railway cable work, the insulator having a large hole in order to fit the large heavy steel pin on the left. The lower insulator in the second row is of the pony type for telephone line work. The two insulators at the right are for high-voltage lines, the glass one at the extreme right being designed for 4000 volts, and is mounted on a steel pin with porcelain base.

Compensated Revolving Field Generators.

It is well known that when the load on an electric generator, direct or alternating, is increased, the potential will drop unless the field excitation is also increased. This is due to the resistance of the armature, the inductance of the armature, and the reaction of the armature on the field poles, the latter reducing the amount of effective magnetic flux. The potential at a distant point, when the current is used for lights or motors, falls even more on account of the resistance and inductance of the line. To compensate for this direct-current dynamos have been compounded by passing the main current through series coils on the poles and so adjusted that the potential at the machine increases with increasing load.

On alternating and polyphase machines the same result has been obtained by rectifying the main or an induced current, and using it for the same purpose; and, except for a slight increase in complication, the method is just as effective as on direct-current machines, so long as the alternating current is in phase with the potential, which unfortunately is rarely the case in ordinary operation, since partly-load transformers and induction motors produce a lagging current which requires a greater field excitation to produce the normal potential. This has not heretofore been provided for, but is in the case of the machines to be described.

The line of machines as developed and now being built by the

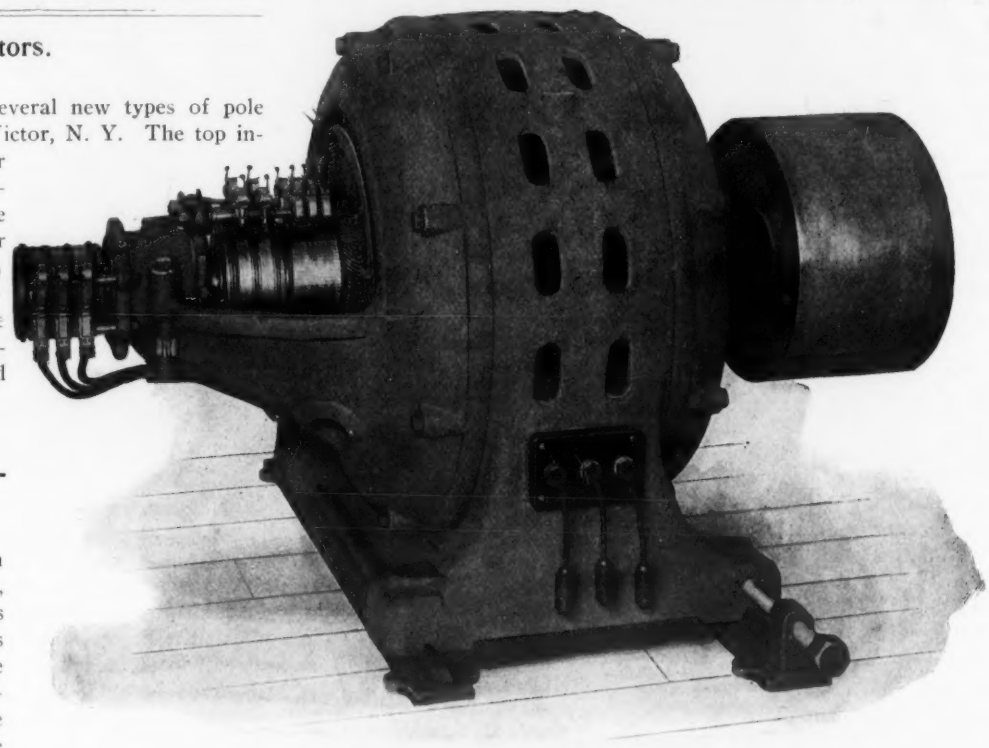


FIG. 1.—COMPENSATED REVOLVING FIELD ARMATURE.

General Electric Company are belted and will fill the wants of installations where the greatest trouble is experienced, i. e., where the size of the motor units is likely to be a large per cent. of the size of the generator units.

The design is based on a principle radically different from any-

thing which has heretofore been employed. The new feature is the method of excitation and gives an automatic compounding far superior in results from that which can be obtained by any other known method, and at the same time there is nothing but the simplest and most reliable mechanism used.

The distinctive advantage of this method of compounding is that it automatically adjusts the potential for all variations and degrees of inductive and non-inductive load without any mechanical change or adjustment. In any alternator, to maintain a given potential with a given inductive current requires a larger amount of field excitation than is needed with the same potential and load if the current is non-inductive. Thus, in all types of alternators heretofore designed, the compounding required for non-inductive loads has been entirely insufficient for inductive conditions. With the loads that ordinarily have to be provided for on alternating current circuits there are wide variations in the power factor, especially in cases where a considerable proportion of the load is in motors.

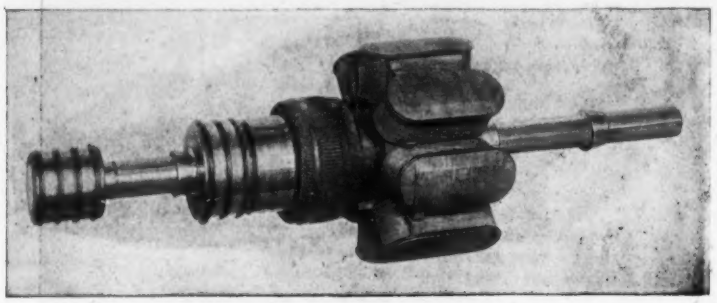


FIG. 2.—STATIONARY ARMATURE.

Consequently, the achievement of an automatic means of field adjustment for all kinds and degrees of load is of the greatest practical value.

The means by which this result is accomplished are as follows: The shaft of the generator which carries the revolving field also carries the armature of the exciter, which has the same number of poles as the alternator, so that the two operate in synchronous relation. Besides its commutator, which delivers current to the field of the alternator and to the fields of the exciter, the latter contains three collector rings. Over these collector rings it receives current from one or several series transformers inserted into the lines leading from the alternator. This alternating current, passing through the exciter armature, reacts magnetically upon the exciter field in proportion to the strength and to the phase relation of the alternating current. In consequence thereof, the magnetic field, and hence the voltage of the exciter, is due to the combined effect of this shunt field and the magnetic reaction of the alternating current.

The connections between the armatures of the two machines are so made that the polarities induced in the exciter armature are somewhat ahead of the exciter field magnetization, but still so that it will assist the field magnets. The result is that with increasing main current the current passing through the exciter armature strengthens the exciter fields and thereby the fields of the generator. If the current lags, as under an inductive load, the magnetization produced by the alternating current in the armature comes more nearly in line with the exciter field magnetization, thus strengthening the field more with a given line current. This is so adjusted as to give the necessary rise of exciter voltage as non-inductive load increases, and without other adjustment to give a greater rise of exciter voltage with the addition of inductive load. These are the first machines to which this perfect system of compounding has been applied. They accomplish the desired result with wonderful accuracy, and without any liability to sparking or trouble of any kind.

In addition to the exciter armature and its commutator, the alternator shaft carries two sets of collector rings, one set delivering direct current to the alternator field, and the other set delivering alternating current to the exciter armature, as described. The commutator and all the collector rings are fitted with carbon brushes and all operate at pressures below 75 volts, so that all parts may be freely handled under all conditions.

No alternating current is rectified as in other compound alternators, and no conditions exist which will produce trouble through sparking or improper brush action. In fact, one of these machines requires no more care than that which is generally bestowed upon the exciter of a separately excited alternator.

With each alternator is furnished a transformer of compact design for the purposes described above, and a small rheostat, which is connected in series with the exciter field winding. These can be mounted wherever convenient. No other accessories are required with the machine except such switchboard arrangements as the service may demand.

The alternator is of the revolving field type, with stationary distributed armature winding, the design being such that a vigorous ventilation is maintained through all parts. Fig. 1 shows one of these machines of 75-kw capacity and having eight poles, designed for a frequency of 60.

The armature coils are insulated in the same manner as the coils for high potential machines. They are held in place by wooden wedges, which fastening allows them to be easily removed, and has been found very satisfactory in the vast amount of machinery built in this way. The poles of the revolving field are built up of laminations and are fitted into dovetail slots in the steel hub with taper keys. These keys are easily driven out, so there is no trouble to remove or replace a pole piece. The field coils are made of flat strip copper, wound on edge, each coil consisting of a single spiral, paper being used to insulate between successive turns.

The mechanical design of these machines is such as to render all parts readily removable. The distribution of weight and pull is such as to give a particularly good action on the bearings. The machines stand on rails, so that the belt tension can be adjusted. They are so proportioned as to afford effective use of practically all the magnetic material. The efficiencies obtained are consequently high, and the weight of the machines per kilowatt of output is small.

The standard designs for these machines are adapted to three-phase or two-phase windings without change save in the coils themselves, the exciter and all accessories being the same for both. The makers have not yet standardized any single-phase or monocyclic windings for these machines, the intention for the present being to use three-phase windings for cases for which monocyclic or single-phase machines would ordinarily be required.

The machines will carry their full rated capacity, two or three-phase non-inductive load, continuously with a rise of temperature

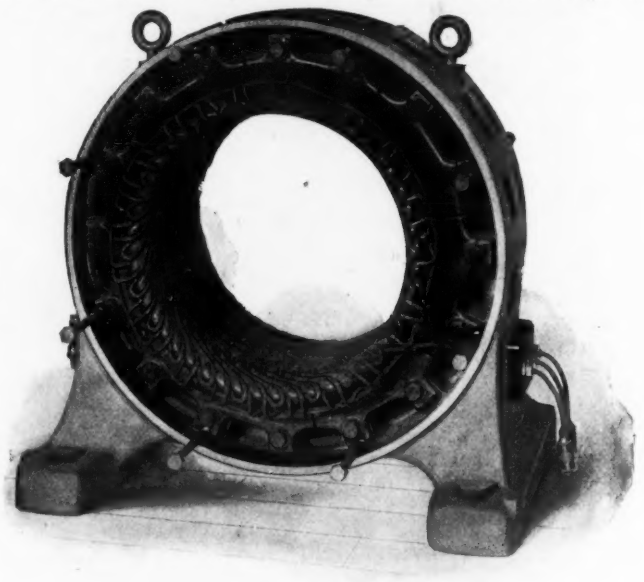


FIG. 3.—REVOLVING FIELD AND EXCITER ARMATURE ON THE SAME SHAFT.

not to exceed 40° C. in any part, and will carry 25 per cent. overload for two hours without rise of temperature exceeding 25° C. above the surrounding air. All machines with three-phase windings are guaranteed to carry 80 per cent. of their rated output in single-phase current. Under these conditions the same temperature guarantee can be given as for two and three-phase rating. The makers also guarantee that these machines with three-phase windings will carry their full load output in single-phase current for a period of three hours without injurious heating.

The machines can be operated at their full three-phase rating when they are used to deliver power for both lighting and motor service with the lighting distributed for one phase only, and the

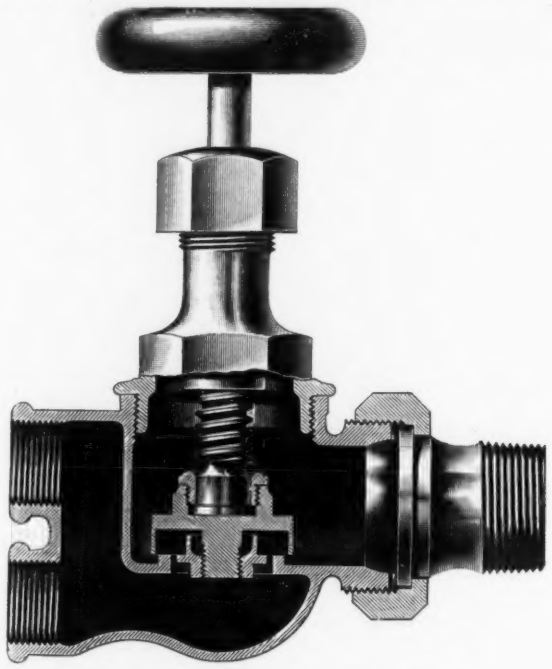
motors connected to all three-phases. The machines can be operated in this way where the lighting load is a large proportion of the whole. The reason for this is that the motors tend to draw most of their power from the phases which operate at the highest voltages; consequently, the motors tend to correct the unbalanced condition that arises from the operation of lights from a single phase. This is of great practical value, as a single-phase current is for many reasons more convenient than polyphase current for lighting purposes.

While this method of operation is recommended for many installations, the machines are, of course, practically adapted to any system of polyphase lighting distribution. The machines have been so designed that they can be wound for the following potentials:

Three-phase windings; 480, 600, 1150 and 3450 volts. Two-phase windings: 480, 1150, 2300 and 3450 volts. Machines with three-phase windings and arranged for 2300 volts are the standard.

The Collis Valve.

This valve, the parts of which are shown in section in the accompanying cut, is designed for use in connection with radiators, heating



THE COLLIS VALVE.

coils, etc. It enables a perfect circulation of dry steam at all times up to the seat of the valve, and it can be adapted for use with any of the automatic heat regulating systems. It is made in the following three sizes: 1¼ inch, 1½ inch and 2 inches.

Only one valve is required for a radiator, and the circulation of steam is active and positive whether the valve is open, partly open or closed.

The Collis circulating valve is manufactured by Messrs. Jenkins Bros., New York.

Carbon Works Damaged by Fire.

The plant of the United States Carbon Company, Cleveland, was seriously damaged by fire last Sunday evening. A portion of the second floor of the factory was entirely cleaned out while much of the machinery on the floor below was damaged by water. A representative of the company stated that the loss was about $10,000, but fully insured. The machinery will be put in order at once and the factory will be running as usual within ten days.

Excitant for Primary Batteries.

The Federal Battery Company, of New York, is manufacturing a battery excitant called "Federal Salt," as a substitute for sal ammoniac in Leclanche type batteries. The salt is claimed to give a higher e. m. f. and to last longer than sal ammoniac, and to reduce the internal resistance of the cell. The factors leading to these improvements are the entire absence of crystals on the carbon and zinc; the electrolyte contains its own depolarizer, which in conjunction with the other salts present having higher heat equivalents than sal ammoniac, increases the e. m. f.; and as there is no insoluble matter produced, the internal resistance is lessened as the zinc salt is formed, the electrolyte thus becoming a better conductor, as is proved by the increase of amperes as the cell is used.

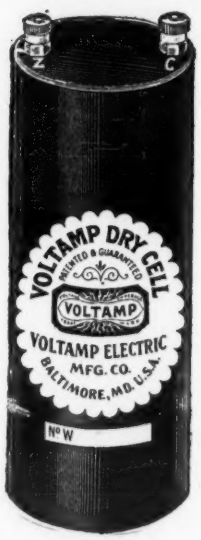
PACKAGE OF FEDERAL SALT.

In a sal ammoniac solution the internal resistance increases as the oxychloride of zinc crystals are formed and reduce the surface of the carbon and zinc. These crystals, which clog the pores of the carbon, prevent a rapid recuperation and lessen the efficiency of the cell. A notable feature of a "Federal Salt" solution not possessed by a sal ammoniac solution, is the white milky appearance the electrolyte assumes when the cell is almost exhausted.

Another feature of the excitant is its entire freedom from creeping salts. When sal ammoniac is dissolved in water, it produces a very considerable lowering of temperature. The glass jar at once begins to condense moisture on its outside surface, which continues more or less during the life of the cell as the ammonium is liberated. The salts have thus a medium through which to diffiuse, and creep over the jar and carbon. "Federal Salt" has no chemical action of this description, and is consequently free from creeping salts. The excitant is put up in neat packages, as shown in the accompanying cut.

The Voltamp Dry Cell.

The improvement in recent years in the manufacture of dry cells is well exemplified by the "Voltamp" dry cell, made by the Voltamp Electric Manufacturing Company, Baltimore, Md. The mechanical appearance of this cell is admirable. The cylindrical surface is covered with an imitation of leather, and the binding posts are secured to a piece of rubber flush with the top of the cell, their polarity being indicated by the letters "C" and "Z" stamped in the rubber. The whole is enclosed in a neat paper case, in the lid of which there are two holes above the binding posts which permit the cell to be roughly tested by the purchaser if there is an electric bell convenient. Following are the results of a test made for us by an electrical engineer in whose hands a cell was placed for report. As will be seen, the tests were particularly severe, being made at rates of discharge much beyond what such cells are usually called on to give.



VOLTAMP DRY CELL.

The dimensions of the cell tested were 2½ inches in diameter by 6¼ inches high. The voltage on open circuit at the beginning of the test was 1.58 volts. When tested through a resistance of 1.43 ohms, the current at the beginning was 1 ampere and at the end of fifteen minutes .88 ampere, the average current being .917 ampere. The voltage at the close of the run was 1.35 volts and the internal resistance .162 ohm.

After two hours' rest, the cell was tested through a resistance of .136 ohm. At the beginning the current was 5.2 amperes, and was 3.57 amperes at the end of ten minutes, the average current during the run being 4.125 amperes. At the end of the discharge the voltage was 1.19, two hours later 1.39 volts and the next morning 1.49 volts. After the measurement of the latter voltage the cell was short-circuited and gave 8.2 amperes, showing an internal resistance of .169 ohms.

After a day's rest the cell was subjected to an intermittent test, 10 seconds on and 10 seconds off. The test was continued over six hours with the following results: At the beginning the current was 1 ampere. at the end of three hours .8 ampere and at the end of six hours .7 ampere, the voltage at the close of the test being 1.12.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET witnessed a most decisive rally toward its close, owing first of all to the proposed purchase of bonds by the government, thus releasing some of the big surplusage in the Treasury, and, next, to the better showing of the bank reserves, the statement being even better than was expected. The new United States 4s reached the highest point yet attained. Electrical stocks were all strong and active, and American Bell Telephone, which might have been expected to go off under the threatened pounding of the new opposition, went up and closed higher than for some time past, to the tune of "There's life in the old dog yet." General Electric also put up a front that carried it beyond the antepanic figures. During the week 1730 shares of Western Union were traded in, closing at 89, a gain of ¾. On sales of 12,865 shares, General Electric went up to 126 at the close, a gain of 4 points. The much-tormented Brooklyn Rapid Transit, on sales of 164,000 shares, closed the week at 89¼, a gain of 3 points. Manhattan Elevated, on 184,000 shares, was up to 106, a gain of 4, and Metropolitan Street Railway, on 13,065 shares, went up to 195½, a gain of 3½. In Boston, American Bell Telephone closed at 362-364; Erie Telephone, 109-110; Westinghouse Electric preferred, 64-65; West End, 92-93; Boston Elevated, 104. In Philadelphia, Electric Storage Battery closed at 124 preferred; 117-120 common; Philadelphia Traction, 96; Union Traction, 39⅜; Pittsburg Traction, 28⅜; Rochester Passenger Railway, 16½. In Chicago, Metropolitan Elevated common closed at 25¼ and preferred at 80; Chicago City Railway, 285; Union Traction, 26¼; Lake Street Elevated, 16¼; Union Elevated, 101; West Chicago Railway, 117. In the outside market, in New York, Electric Axle was one of the most active stocks, as well as one of the issues the advance in which was of several points. Traders, as well as commission brokers, took a prominent part in the trading. The stock sold up to 8, and closed at 8 bid, a net gain of 2 points. The reports in regard to the Electric Axle Company continue to be of the most promising kind, and friends of the company are predicting with much confidence the success which will be attained by its various electrical devices. Electric Boat was also strong on favorable navy reports of the submarine boat Holland, and sold at 20-21 common, and 38-41 preferred. Electric Vehicle common sold at 65-70 and preferred at 95; New York Electric Vehicle Transportation, 15¾-16¼; New England, 7⅝; Illinois, 3¾-4¼. There was general improvement in other electric industrials.

TELEPHONE STOCKS IN BOSTON.—Telephone stocks in common with the rest of the market have declined from the highest prices of the year, but on the whole they have shown greater strength than any other class of stocks on the Boston Stock Exchange. Telephone stocks are in the investment class, but, for the last few months, there has been considerable speculative buying of Bell Telephone in anticipation of the readjustment of the company's capitalization into a new company, whereby there will be valuable "plums" to stockholders. The Boston News Bureau gives the highest price of the three leading telephone stocks for a series of years:

	1899	1898	1897	1896	1895	1894	1893
Bell Tel.....	386	285	285	211	210	208	212
Erie Tel.....	120	78	77	66¾	69¾	56	50½
New England.	156	145	135	103	90½	68	61½

The dividend record of the above companies has been as follows: Bell Telephone has paid at the rate of 15 per cent. since 1895, 16½ per cent. in 1894, 18 per cent. in 1893, and 15 per cent. in 1892. New England Telephone Company is now paying at the rate of 6 per cent. per annum. In 1897 it paid 5½ per cent, 5 per cent. in 1896, 4½ per cent. in 1895, 4 per cent. in 1894 and 3½ per cent. in 1893 and 1892. The Erie Telephone Company has paid 4 per cent. in all of the above years, but has, within a month, increased its rate to a 5 per cent. basis. It is said to be earning 8 per cent. At 251 for Bell Telephone, the net return, at 15 per cent. per annum, is 4.27 per cent. At 150 for New England, at 6 per cent. per annum, the net return is 4 per cent., and at 108 for Erie Telephone, at 5 per cent. per annum, the net return is 4.62 per cent.

SALE OF THE FIFTH AVENUE STAGE LINE.—The report that the possession of the Fifth Avenue stage line, New York City, has passed to the New York Electric Vehicle Transportation Company, has been confirmed by an officer of the Metropolitan Street Railway Company, who said that the process of changing the stages which now run up and down Fifth Avenue to electrical omnibuses would begin soon. The Fifth Avenue Stage Company was owned by the Elliott F. Shepard estate, and was purchased by the Third Avenue Railroad interests, who resold to William C. Whitney, as agent for the Electric Vehicle Transportation Company. Harry Payne Whitney, the son of William C. Whitney, is president of this latter company. The price paid for the franchise and equipment of the stage company is said to have been $1,000,000. The new stages will be on the lines of the "Columbia" type, it is said, as shown in these pages last week, and will hold twenty inside and four on the roof.

COMMERCIAL CABLE.—As already noted, there will be a special meeting of the shareholders of the Commercial Cable Company on December 4, when the proposition to increase the capital stock from $10,000,000 to $15,000,000 will be formally approved. This action is to be taken in consequence of the rapidly increasing business, which makes necessary the laying of new cables. Although the increase authorized will be $5,000,000, the amount issued will be about $3,500,000. This will be offered to the present shareholders at face value, in the ratio of one share of new stock for every three of the old stock. It is supposed that some of this will be used for cable to Cuba from Key West, but it is not forgotten that there is talk also, not without reason, of a direct cable from New York to Germany.

THE AMERICAN BELL TELEPHONE readjustment plan is in the hands of the executive committee of the company. Announcement is looked for some time before January 1, but no date has been set. Those well informed regarding the affairs of the company say that they anticipate receiving three shares of 5 per cent. stock in the new company for each share of old stock, and, in addition, the valuable right to take additional stock in the new company, all of which should give a value of about $400 per share to Bell Telephone stock, of which nearly $26,000,000 has been issued and is now quoted around 360.

ERIE TELEPHONE STOCK.—Two surprising facts concerning the Erie Telephone Company are that the gross earnings of the Erie Telephone Company are now above $3,300,000, and the net earnings above $1,000,000. Considering that the great gains in Erie have been made gradually during this year, it is probable that Erie Telephone stock is now earning about 8 per cent. The system has gained 36,000 subscribers since January.

Commercial Intelligence.

THE WEEK IN TRADE was in most respects a continuation of all that had gone before during the present year, whose end now draws in sight. The demand for goods of all kinds is excellent. In many lines of industry the complaint is made that the mild, unseasonable weather has checked purchases or consumption of goods, but even such a state of affairs brings its equalization in other quarters. With the ground frozen hard, for example, not a little electrical and street railway work, such as setting poles, excavating for track, laying subways, etc., has to go over until the buds come again on the trees; but this year a lot of it is being pushed far beyond the usual frost line. There is in the electrical field a sense of relief in believing upon good data that copper is not going any higher, but tends to lower, fairer prices, more in keeping with normal cost of production. Copper is such a vital part of electrical construction, every cent additional is felt most seriously. Turning to general features of trade, Dun's says that the signs of shrinkage in the new demand for iron and steel products become more clear, and while prices of pig are maintained without change and billets are quoted lower only because premiums for earlier deliveries are no longer paid, plates are quoted lower at the East, with some small mills selling at 2.5 cents at Pittsburg, and sheets are sold by some works there at $3 to $4 less than the regular price. The strength of bars at the West is largely due to the great demand for cars, of which it is said that 1000 per day are ordered, but at the East prices are a shade lower. The new demand, however, it is pointed out, does not make up for the rapid completion of old orders in some lines, so that competition of works weakens prices. Export trade shows figures likely to overrun $50,000,000 more than last year, and our foreign trade for 1899 will cross the two billion dollar mark. The coal supply has lately been found short, and many railroads complain still of a shortness of freight cars. Bradstreet's reports 199 failures in the United States during the week, against 182 for the previous week, and 229, 235, 308 and 323 for the corresponding weeks of 1898 to 1895. The Middle States had 69; New England, 41; Southern, 25; Western, 33; Northwestern, 9; Pacific, 11; Territories, 11. Canada had 19, against 23 for the preceding week. About 78 per cent. of the total number of concerns failing had $5000 capital or less, and 12 per cent. had from $5000 to $20,000 capital.

NEW SAFETY CABLE FACTORY.—The Safety Insulated Wire & Cable Company, of this city, is about to construct a large plant in the vicinity of Bayonne City, N. J. One of the officers of the company, discussing the subject, says: "Our present premises are inadequate in view of the growing demand, both domestic and foreign, for our specialites. Our works have been going 22 hours per day for the last 18 months, and we have sufficient orders in hand to keep us working at the same high pressure for the next ten months. We have acquired 15 acres of desirable land near Bayonne City, and are now considering the specifications for a $500,000 plant, which will be equipped with up-to-date machinery for the manufacture of submarine cable. The buildings will have a frontage of 600 feet, and on beginning operations, which we hope to do inside of six months, we will employ 400 hands. Being at tidewater, our dock having a bulkhead of 36 feet, we will be in a position to make a bold bid for export cable contracts. In fact, we are now negotiating with a foreign government for submarine cable work. I see no reason why America, with tidewater plants and having the advantages of lake copper, which is the best conductor and cheaper, galvanized iron and steel wire, should not be successful in securing a goodly portion of the world's big cable contracts." The present factory is in the heart of the west side of the city, far from the two rivers, and its productive capacity was long since outgrown.

EMPIRE STATE POWER CO., of Amsterdam, N. Y., is prosecuting actively its work for the electrical development of the power of the Schoharie River, on the 15-mile stretch of which some six powers can well be secured, there being a total drop of 320 feet, without any actual falls. Mr. J. George Kaelber, the energetic president of the company, who is also its general manager, reports that one of the power houses about midway on the section of the river utilized is to be ready by next spring. They have ordered from the Stanley Electric Manufacturing Co. three 900-kw two-phase generators and another 900-kw to follow later. These will generate current at 12,000 volts right in the machine and there will be no stepping up for the line potential. There will be one transmission line of 16 miles to Howe's Cave and one of seven miles to Amsterdam. About 1500-hp will be sent over the longer line and 3000-hp over the shorter. There is a great demand for the power, and one block of 1000-hp has been disposed of already. The order for the turbines had not been given out up to last week, and the company has been debating as to the use of aluminum instead of copper on its transmission circuits.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., is doing a very large business with its presses among the electrical companies of this country and Europe. The General Electric Company has recently placed an order with them for a 26,000 pound press 100 inches wide, and two presses of 20,000 pounds each, and six of 12,000 pounds each. These are for use in punching out armature discs, etc. They are making large shipments to France and Germany, and expect that the establishment of the large electrical factories in Great Britain will bring them considerable business from England. They have recently received orders for a number of presses from Japan. In addition to the above business the Ordnance Department of the Washington Navy Yard has recently received from them six presses and two cutting-off lathes. The Star Ball Retainer Company has placed an order with them for 32 presses, 16 of which have already been shipped. This large business speaks well for the products of the Ferracute Machine Company, who make a line of presses and dies for all kinds of sheet metal work, including special presses for notching armature discs.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical materials are from the port of New York for the week ending this date: Antwerp—44 cases electrical material, $1362. Amsterdam—2 cases electrical material, $37. Athens—2 cases electrical material, $108. Central America—10 cases electrical machinery, $603; 3 cases electrical material, $122. Genoa—5 cases electrical material, $354. Japan—3 cases electrical machinery, $1819. Liverpool—4 cases electrical material, $225. Mexico—3 cases electrical material, $53. Manchester —3 cases electrical machinery, $743. Marseilles—38 cases electrical material, $10,548. New Zealand—1 case electrical machinery, $75. Odessa—5 cases electrical material, $311. Peru—1 case electrical material, $70. St. Petersburg—65 cases electrical machinery, $14 710. United States of Colombia—8 packages electrical material, $190. Uruguay—3 cases electrical material, $9. Venezuela—10 cases electrical material, $100.

THE PRATT CHUCK CO., of Frankfort, N. Y., are sharing in the increased prosperity of the country, as, owing to the large demand for their product, they have not only found it necessary to largely increase their force, but are rebuilding and making additions to their plant in order to meet these demands. Among several foreign orders recently received was a particularly large one from one of the great shipbuilding firms on the Clyde. Their export business bids fair to receive added impetus, as they are now in correspondence with one of the largest railroad systems of Great Britain, which desires to secure a chuck that will not permit the drill to slip under any conditions, intending to introduce the same in the several railroads shops connected therewith. They have already placed a trial order with the firm. In addition to these orders, the company are in receipt of numerous inquiries from all parts of Europe, and also report large increase in their domestic orders.

C. & C. PRINTING OUTFITS.—We are advised that the C. & C. Electric Company have made their "debut" into the field of the equipment of large newspaper printing presses with electric motors, their first order having come last week from the *Evening Telegraph*, of Philadelphia. This order covers four complete equipments for Hoe sextuple presses, each equipment consisting of a special 50-hp slow-speed motor, with controller appliances, etc. They are also building for the Hoe Company a special equipment for testing large presses in their factory, consisting of a large portable truck upon which will be mounted a 50-hp motor of very slow speed and wide speed range, together with the resistances and controllers. The C. & C. Company are busier now than they have ever been, and are finding it necessary to work a night force. Their unusually full order file shows some most interesting contracts, many of them for export.

STANLEY ELECTRIC PROSPECTS.—The prospects of the Stanley Electric Manufacturing Company are the subject of a great deal of interest in Massachusetts, and especially in Berkshire County. The well-informed local press now assumes that the works will be kept at Pittsfield and enlarged. The *Springfield Republican* says: "The cost of transferring the Stanley plant would be enormous, a fact which the stockholders of the Sprague Company probably recognized. Mr. Hine stated that the Stanley Company had contracts on hand at the present time aggregating $500,000, which includes a long-distance transmission plant in California, the largest of its kind in the world, power to be transmitted a distance of 145 miles; a similar plant of a shorter distance in Amsterdam, N. Y., and a transmitting plant in Ouray, Col." The California order for the Standard Company has already been noted in these columns.

NEW YORK FIRE DEPARTMENT is busy on new work and its chief electrician, Mr. H. F. Blackwell, Jr., is preparing specifications for about $25,000 of additional cable required. Other work of general and electrical interest is in hand. The big repair shops of the Fire Department, in West Third Street, will soon be moved to more commodious quarters at the northeast corner of Fifty-sixth Street and Twelfth Avenue, where Commissioner Scannell intends to push the work of constructing a new building, which, when completed, will contain the finest repair shops of the kind in the country. The new building when completed will cost $200,000, and it is estimated will save the city several thousands of dollars every year. About 150 men are employed in the shops.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, have recently installed two additional storage batteries for the Chicago Edison Company, one battery in the Adams Street station, consisting of 80-type "H" cells on each side of the three-wire system and having an ampere capacity of 23,500 at an eight-hour rate. This is practically a duplicate of a large battery installed in the same station last year. In the Twenty-seventh Street station, at 2640 Wabash Avenue, Chicago, they have just completed the installation of a smaller battery, consisting of 75-type "G" cells on each side of the three-wire system and having a capacity of 2080 amperes at an eight-hour rate.

NEW STANDARD CABLE FACTORY.—Note has already been made from time to time of the fact that the Standard Underground Cable Company is constructing a large plant at Perth Amboy, N. J. Eight and a half acres of land have been acquired, and three-story buildings 350 feet long by 65 feet wide are being hastened to completion. Newark contractors have undertaken to complete the work by February 1, 1900. The estimated cost is $260,000. On beginning operations 220 hands will be employed. The location of the new plant being at tidewater, vessels can be docked there and the cable loaded into them as it is manufactured. The company's other new factory is on the Pacific Coast.

TELEPHONE APPARATUS.—It is asserted from Chicago that the Western Electric Manufacturing Company, the manufacturer of material for the Bell Telephone licensee companies, has been mailing notices to all the subcompanies that certain royalties heretofore paid on switchboards and bells would be cancelled beginning with October 31.

HEAVY COPPER PRODUCTION.—According to the figures compiled by the New York Metal Exchange, the production of copper in October was almost 24,000 tons, an amount very much in excess of that in any other month in this history of the Exchange.

Special Correspondence.

NEW YORK NOTES.

New York, Nov. 21, 1899.

THE LAWRENCE MACHINE COMPANY, of Lawrence, Mass., manufacturers of centrifugal pumps, have opened an office under their own name at 39-41 Cortlandt Street, New York. They will be represented by Mr. H. E. Maxfield, who is favorably known throughout the trade.

METROPOLITAN COMBINATION CARS.—At the approach of cold weather the Metropolitan Street Railway Company proceeded to lay its new combination cars off for the winter, when, to the surprise of the officers of the road, the mails were crowded with protests, mainly from smokers. As a result the company has decided to retain the cars in service all winter. There are 108 of them and they will be divided among various lines.

INCREASE OF PLANT.—The New York & Queens Light & Power Company intends to increase the size of its plant in Flushing. The Flushing Gas & Electric Light Company and the Newtown Gas & Electric Light Company were recently consolidated with the New York & Queens Light & Power Company, under the latter name, with a capital of $1,000,000. The company intends to enlarge its plant, so that it can light the old towns of Flushing and Newtown.

THE NATIONAL ACADEMY OF SCIENCES began its autumn meetings at Columbia University in this city on Nov. 15. President Seth Low, of Columbia, welcomed the academy on behalf of the university and spoke of the importance of its discussions and meetings. Among the papers read at the afternoon session of that day were two of interest to electrical people. They were "The Electro-Chemical Equivalent of Copper and Silver," by Prof. Theodore William Richards, and "The Hydrogen Vacua of Dewar," by Prof. George F. Barker.

NEW CAR EQUIPMENT.—The Third Avenue Railroad Company began running its new cars in 125th Street last week, and it is expected that within a week or ten days at the latest there will be 100 or more of them running. The cars are said to be the largest and finest surface railroad cars in the country. They are 41 feet long over all, the body of the car, which rests in steel channel beams, being 32 feet long and 26½ inches above the rail. Each car is fitted with air brakes, and in addition to these are the ordinary brakes, so that in case one fails to work, the other can be used. Each car is illuminated with 20 electric lights, so distributed as to light every seat.

NEW JERSEY TROLLEY OFFICERS.—The trolley trust, which will operate all the trolley lines in North Hudson, Passaic County and Bergen County, and run lines from Jersey City to Little Falls, beyond Paterson, has organized in Hoboken, by the election of the following officers: President, David Young; vice-president, John F. Shanley; treasurer, George W. Roe, all of Newark; and secretary, William C. Doubleday, of Jersey City. These were elected directors: William C. Shanley, William J. Davis, Bird W. Spencer, Peter Hauck, Jr., Edward L. Young, Philip Hexamer, James K. Corbiere, Halsey M. Barrett, David Young, and John W. Omberson. It is capitalized at $20,000,000. David Young is made general manager.

WIRELESS TELEGRAPH AND TELEPHONE COMPANY.—It is reported that a wireless telegraph and telephone company is in process of formation in this city, and will be incorporated in Delaware during the present week. The capitalization of the new concern will be $12,500,000, of which $2,500,000 will be debenture stock. It is stated that the company has recently been conducting experiments between Providence and Boston with marked success. Mr. Graham, counsel for the new company, alleges that the Marconi system is an infringement on patents secured some years ago by an American inventor, which are held now by the proposed company, and that when Signor Marconi was in this country he had been served with papers in a suit restraining him from further using the system in the United States.

KLONDIKE LIFE.—Mr. Thomas A. Edison is now developing at his laboratory, in West Orange, N. J., a remarkable collection of films for a movable picture machine, which will show the actual life in the Klondike. Mr. Edison started his photographing party to the Klondike in June, 1898, under R. K. Bonine, his personal representative. The pictures were taken by a machine invented by Mr. Edison, which produced a picture nine times the size of ordinary ones and had a capacity for taking 20 pictures in a second. These views will be presented in the form of a moving panorama, and the Klondike exhibit will have an elevated site in Paris on the right of the Trocadero. The views from the seacoast to Dawson are finished, and the principal view points from Dawson, descending the rivers to St. Michael, will be completed in a few weeks.

THE RAPID TRANSIT TUNNEL.—It is reported that two French engineering concerns will send representatives to New York to examine the rapid transit plans with a view to taking part in the construction of the tunnel. Under the rapid transit contract the French contractors would have to make arrangements as subcontractors, because the builders of the tunnel must agree to operate the railroad for 50 years, and no French concern could do this independently of any other railroads. The bids for the construction of the tunnel will be opened on Jan. 15. It was stated that the Metropolitan Street Railway Company would bid for the work, and possibly the Manhattan Elevated Railway Company, and the Third Avenue Railway Company. President Vreeland, of the Metropolitan Street Railway Company, however, denies that his company will make any effort to engage in the enterprise.

THE UNITED ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF NEW YORK held a meeting in Troy and Albany on Nov. 15. The meeting was very successful. The officers of the association are Rudolph Schmidt, of Rochester, president; David Cronin, of Syracuse, vice-president; J. C. Stearns, of Buffalo, treasurer, and Wells Dygart, of Buffalo, secretary. The above named gentlemen, with E. F. Lester, W. H. Morton and E. G. Bernard, comprise the directors of the association. The Eastern Association, which is one of the local organizations of which the United Association is formed, gave a banquet at the Hotel Ten Eyck at Albany in the evening. There were about 70 members present, including Mr. Hover, of the New York Insulated Wire Company; Mr. Jones, of J. Jones & Son, and several of the principal New York contractors, including Messrs. Eidlitz, Hunt, Hall and Davis.

ELECTRIC TRACTION ON THE ERIE CANAL.—It is stated that at least 200 electric motors will be operating upon the Erie Canal next season, which equipment will be sufficient to handle at least 1000 boats. Mr. A. B. Donaldson, secretary and treasurer of the Erie Canal Electric Traction Company, recently visited Chicago, where he inspected a new "trackless trolley motor," which, it is stated, is especially adapted for the propulsion of canal boats. In this connection it was reported last week that Mr. W. C. Whitney and associates were parties to negotiations which may ultimately result in placing the control of the canals of this state in their hands. These interests, it is stated, have in hand a new invention in the form of a motor vehicle designed to run along the towpath and tow the canal boats. It is constructed to carry a storage battery and will also be used in connection with a trolley wire strung on poles along the towpath.

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Nov. 18, 1899.

REMOVAL.—The offices of Morse, Williams & Company, elevator manufacturers, 1105 Frankford Avenue, Philadelphia, have been removed to the 12th floor, West End Trust Building, corner Broad and South Penn Square. Its factory address, however, will remain the same as before.

THE STEWART ELECTRICAL COMPANY, Fifth and Sycamore streets, Philadelphia, stands ready to help others out of trouble—electrical trouble. The company carries on an extensive repair business; rewinds armatures, and fields and refills commutators. It deals in both new and secondhand electrical apparatus, and is a good concern to keep in touch with.

THE FRANKLIN SUPPLY HOUSE, H. P. Feister, proprietor, on Nov. 14 sold its good will, stock and fixtures to the H. C. Roberts Electric Supply Company, 831 Arch Street, this city. All orders now on hand or received by the Franklin Supply House after the above named date will be filled by the Roberts Company. Future orders should be addressed to it.

MR. GEO. W. LORD, manufacturer of Lord's Boiler Compounds, will remove to his new plant at 2238 to 2250 North Ninth Street, on or about Dec. 1. The new plant covers a ground space of 150 by 175 feet, and consists of a three-story and basement brick building. It will be equipped with the latest apparatus for manufacturing the chemicals used in the preparation of the many formulas of Lord's Boiler Compounds. It is 23 years since Mr. Lord located at the present mill-site.

MR. CHARLES M. WILKINS has been elected president, as noted in these columns, of the National Electrical Trade Association, a compliment which not only does honor to the old house of Partrick & Carter, but is much appreciated by electrical Philadelphia in general, where the firm has so long been known. It is felt that in such hands the important questions of trade credits and all that pertains to them are safely placed and a pledge is given of good work for the common welfare.

THE WALKER ELECTRICAL CONSTRUCTION COMPANY, 249 South American Street, Philadelphia, is very busy at the present time. Among recent contracts may be mentioned a switchboard for the Inland Traction Company, Souderton, Pa., and a switchboard and large panel board for the Penn Mutual Building, Philadelphia. The Reading Railway is installing a model 500-volt power plant at Port Richmond, Philadelphia. Burhorn & Granger are the contracting engineers. The contract for a rather complicated switchboard and the wiring for the machines has been taken by the Walker Electrical Construction Company. Among other contracts are a switchboard for the Scott Paper Company, Philadelphia, and a small board for the Sterlingworth Steel Company, the latter through the Crocker-Wheeler Company, of Ampere, N. J. The company also has two government contracts, one for a 14-foot switchboard for the Kansas City post office and custom house, and one for the Detroit post office and custom house, for both of which Messrs. Kingsbury, Samuel & Co. are the contracting engineers.

COMPLIMENTARY DINNER.—Mr. Elmer P. Morris, of the Morris Electric Company of New York, on Nov. 14 tendered a complimentary dinner at the Bingham House in this city to his friends and the press. The menu was an inviting one, and at its conclusion remarks were made by Mr. C. C. Bent, superintendent of the Baltimore & Ohio Railroad. Mr. J. B. MacAfee, president of the Railways Company General & American Engineering Company, Philadelphia, and Mr. Elmer P. Morris. The work of the pioneers in electric railway development was particularly referred to, mention being made of such names as Vandepoele, Sprague, Thomson, Baker, Duncan, Greenwood and Pierson. The dinner party consisted of 18 gentlemen and included Mr. George Mason, Potomac Terra-Cotta Company, Washington, D. C.; S. H. Harrington, Harrington Rail Bonding Company, New York; Elmer P. Morris, Morris Electric Company, New York; John Blair MacAfee, president Railways Company General & American Engineering Company, Philadelphia; George F. Porter, of W. R. Brixey, New York; D. A. Hegarty, of the Railways Company General, Philadelphia; W. E. Harrington, Camden & Suburban Railway Company; J. Franklin Stevens, Keystone Electrical Instrument Company, Philadelphia; W. K. Beard, Stephen Goddard and C. B. Fairchild. The dinner was given by the Morris Electric Company to celebrate the shipment to Havana, Cuba, of 50 carloads of Mason terra-cotta conduits. This was the initial shipment on the contract held by the Morris Company for supplies for the construction and equipment of the Havana Electric Railway.

Pittsburg, Pa., Nov. 18, 1899.

MR. ARTHUR WARREN, the manager of the Publication and Advertising Department of the Westinghouse companies, has departed upon one of his periodical trips to London, England.

THE AMERICAN INSTITUTE OF ARCHITECTS held their thirty-third annual convention in this city last week. During their stay they paid a visit to the Westinghouse companies at Wilmerding and East Pittsburg.

MR. ALBERT SCHMID, who was for many years superintendent of the Westinghouse Electric Company's shops in this city, but now in charge of the French Westinghouse Company, has returned to France after a protracted visit here.

MR. H. C. FRICK, the American Coke King, has purchased the Connellsville, New Haven & Leisenring Electric Railway for $123,000. This line runs through the Monongahela coke region and when all the contemplated extensions are completed it will be 30 miles long.

THE UNION SWITCH & SIGNAL COMPANY, of this city, manufacturers of the Westinghouse electric and pneumatic signal system, has decided to build an addition to the factory at Swissvale, Pa. This extension will give employment to 500 men. The improvement will cost $250,000.

MR. GUSTAV SVALLING, the president and general manager of the Falum Car & Locomotive Works, of Falum, Sweden, was in this city last week for the purpose of ordering a large number of electric motors from the Westinghouse Company. These motors will be used in the operation of the machine shops at Mr. Svalling's factory in Sweden.

MR. E. ROWLAND HILL, an electrician of the Westinghouse Electric & Manufacturing Company, prepared a paper for the convention of architects, entitled "Electricity in Modern Buildings," but owing to his absence from the city he could not personally read it. Mr. C. F. Scott, the well known chief electrician of the company, however, read the paper to the visitors, and it was very enthusiastically received.

Cleveland, Ohio, Nov. 18, 1899.

THE ALLIANCE GAS & ELECTRIC COMPANY, of Alliance, has been incorporated, with a capital of $165,000, to furnish power, heat and light.

THE UNITED STATES TELEPHONE COMPANY is installing a system at Salem, Ohio, under the name of the Columbiana County Telephone Company. A rate war with the established Bell Company is in prospect.

TELEPHONE INJUNCTIONS LIFTED.—The City of Troy, Ohio, has been defeated in litigation to prevent the United States Telephone Company from installing a new system. The Common Pleas Court of that city decided that a telephone system is a public utility and injunctions restraining its construction are unlawful. Three injunctions had been filed against the company.

MESSRS. SIPE & SIGLER, manufacturers of the Willard battery, are elated at the outcome of a suit against the Wilmington City Electric Company, of Wilmington, Del. The equipment of batteries for the Wilmington concern was furnished by the local firm and the suit was contested by them. An injunction was asked for, but the suit was allowed to go by default. Sipe & Sigler are making some extensive improvements to their plant which will greatly increase their output. At present there is an immense demand for automobile batteries. A new departure which is being watched with great interest by this company is the equipment for the Jeffrey Manufacturing Company of Columbus, of three sets of batteries for storage battery locomotives, which the Columbus company is building for mining purposes.

A CASE OF CARRYING COAL TO NEWCASTLE.—With several of the largest wire mills in the country located in Cleveland, it seems a strange proceeding for a local concern to import wire from England, but this is what the Adams-Bagnall Electric Company has been obliged to do in order to take care of orders. Before this shipment was received, the company was obliged to turn down several contracts through inability to secure material. Incidentally it might be mentioned that the present condition of the wire market is by no means improved, some of the Cleveland mills being tied up through inability to secure coal, the coal in turn being tied up through a shortage of cars. The Adams-Bagnall Company is at work on an order for 1200 constant current series enclosed lamps for the Allegheny County Light Company of Pittsburg. Several shipments have recently been made to Brussels, Belgium, and a large one to Japan.

Cincinnati, Ohio, Nov. 18, 1899.

MESSRS. ED VAN WINKLE and Charles Kuntz, of the traveling staff of the Post-Glover Company, returned to-day from business trips. Mr. Kuntz reports business good in the Virginias.

THE DEVERE ELECTRIC COMPANY has secured the contract for wiring the St. Bernard Catholic Church and was notified this morning that its bid for doing the wiring and all the general electric work on the handsome new Union Depot in Dayton had also been accepted.

THE JANTZ & LEIST ELECTRIC COMPANY has secured the contract for equipping the Hauck Brewing Company on Dayton Street with a new 45-hp direct connected motor and several 5-hp motors. Mr. Leist says business is booming.

PRESIDENT GEORGE BULLOCK, of the Bullock Manufacturing Company, is still in New York. He is expected at the works in Norwood early next week. The company is negotiating for several new foreign agencies. During the week a number of orders have been received for 150 and 100-kw machines.

WORK WELL DONE.—One of the neatest electrical jobs in the city is that just completed for the Business Men's Club. The work was under the supervision of the Lawton-Beattie Company. This company has also arranged for the installation of some exceedingly fine and intricately constructed switchboards—one valued at $3000.

ELECTRIC EQUIPMENT FOR A PIANO FACTORY.—The plant of the Howard Piano Company in Dayton, Ky., recently established by the John Church Company (which brought the business there from Boston), will be electrically fitted out by the Lawton-Beattie Company, of this city. There will be some 800 lights, several motors and other machinery.

THE POST-GLOVER COMPANY will put in the cables and batteries and will furnish all the construction material for the new independent telephone plant soon to be started in Wilmington, Ohio. Col. C. R. Fisher, of Governor Bushnell's staff, is at the head of the new venture. The same company put in the electric plant and appliances for the new Lancaster (Ky.) opera house, which will be formally opened on Tuesday next. It furnished everything.

WESTERN NOTES.

Chicago, Ill., Nov. 18, 1899.

SAFE ELECTRIC WIRING.—At the regular meeting of the Chicago Architectural Club, on the evening of Nov. 13, Mr. Arthur Frantzen read a paper treating of the essentials for safe electric wiring.

MR. E. P. WARNER, electrical engineer of the Western Electric Company, is to read a paper on December 1 before the Chicago Electrical Association on the subject of "Alternating Current Arc Lamps" at the rooms, Monadnock Building.

COMPRESSED AIR CARS.—The Union Traction Company is planning an extension of its compressed air car service. The trial of the powerful motors on the "owl" cars of the "limits" line, it is said, has proved so satisfactory that more of them are to be put into use soon. The company's officials are keeping the details of their plans a secret. Whether it is the intention of the company to simply extend its night car service or to try "air" cars in the day time remains to be seen.

FAST TELEGRAPH TESTS.—Anton Pollak and Josef Virag, inventors of the system of rapid telegraphy, have arrived in Chicago from Budapest, Hungary, to make demonstrations of their invention. Their series of experiments, which are to be conducted in the office of the *Tribune*, will be the first made in the United States of their system of telegraphy. The first test is to be an attempt to send 600 words a minute over a distance of about 600 miles. The electrical experts of Chicago and of the colleges and universities near by will be invited to be present when the tests are made.

AUTOMOBILE MAIL WAGONS.—The Post Office Department at Washington has invited proposals for carrying mail by automobiles between the post office in Chicago and two postal stations and also for the same service in screen wagons, one of these methods to be selected later. If results favorable to the automobile are gained from this test it is probable that automobiles will eventually supersede screen wagon service in many large cities and also take the place of electric cars for carrying mails where automobiles are permitted to run at a high rate of speed.

ELEVATED EXTENSION.—The Metropolitan Elevated Railroad Company has decided to extend its southwestern branch for several blocks, tapping the steam surface tracks of the Chicago, Burlington & Quincy road in the vicinity of the Douglas Park station. The right of way for the proposed extension is practically in the hands of the "L" company. There is also a prospect of an extension of the Metropolitan Company's Garfield Park branch half a mile, from West Forty-eighth Street to West Fifty-second Street. This will tap the main line of the Suburban Electric road, which runs to La Grange, Riverside and other southwestern suburbs.

A NEW MESSENGER SERVICE has been inaugurated in this city under the direction of the Illinois District Telegraph Company, which was organized nearly a year ago. The new company has taken charge of the delivery service of the Western Union Telegraph Company, each office of which has also become a branch of the Illinois District Telegraph Company. The new company was organized by H. D. Bennett, assistant general superintendent of the Western Union Telegraph Company, who lives at Columbus, Ohio. It now operates in Indiana, Iowa, Kentucky, Michigan, Missouri, Minnesota, Ohio, Oklahoma, Pennsylvania, Wisconsin and Virginia.

NEW TYPE OF AUTOMOBILE.—It is stated that a new automobile has been invented by two Chicago men, which promises to revolutionize the horseless carriage industry. Fred J. Newman and Joseph Ladwinka are the inventors of the improved automobile, the difference between it and other self-propelling vehicles being that the motive power is distributed at four points, the motors being concealed in airtight, dustproof cases of steel in the four hubs. According to Charles Berg and Harry Irwin, who are backing the enterprise, with the new patent they say they can manufacture vehicles of all kinds 40 per cent. cheaper than any other similar vehicle, that their hub motors will be from 20 to 35 per cent. lighter, and that the annoying squeak and cumbersome boxes beneath the platform will be lacking. One of the new vehicles has been tried and is said to have worked well.

THE TELEPHONE TUNNEL, which is just now a subject of dispute, is being built by the Illinois Telephone & Telegraph Company for its Strowger system. It will extend from Fullerton Avenue, on the North Side, south to Fifty-fifth Street, with a branch westward to Western Avenue. It will be 4 feet wide and 7 feet high, lined with concrete, and will be fitted with racks for the wires and cables. The crown is about 30 feet below the street level, to avoid interference with sewers and pipes. It was expected that no trouble would be caused from disturbance, but work was stopped recently by order of the department of public works on complaints that certain buildings were affected. The company, however, claims that its photographs and records show that the cracks which led to the complaints existed before work was commenced on the tunnel.

RAILWAY DIFFERENCES NEARLY SETTLED.—The prospect of a settlement of the differences between the Chicago Union Traction Company and the Yerkes' interests is better than it has been at any time since the new street railway company assumed control of the North and West Side lines. Negotiations between representatives of the two factions, which for some time have been threatening to lead to serious differences, are now progressing satisfactorily toward an adjustment of the difficulties. It is stated that one of the principal causes of discontent on the part of the Union Traction people was the lease by which the Chicago Consolidated Traction Company, now Mr. Yerkes' pet company, secured the right to enter the business district. The story is that a lease was executed between the Consolidated Company and the old West Chicago Street Railway Company, giving the former permission to use the tracks of the latter and enter the central district by way of Lake Street and the loop, running over Dearborn, Randolph, State and Lake streets. The Union Traction Company claimed that when it guaranteed the stock of the

West Chicago Company it was not aware of the existence of a lease giving to an outside road, which at any time might become a competitor, the right of entrance into the city over its tracks. Its directors also said that when they bought the West Chicago Company they purchased its right of way absolutely.

Indianapolis, Nov. 18, 1899.

NEW TELEPHONE CORPORATION.—The Posey County Telephone Company has filed articles of incorporation with the secretary of state. Capital stock, $10,000.

TROLLEY MAIL TRAINS.—The Indiana Electric Railway Company has contracted to carry mail between Goshen and South Bend, 26 miles, on its trolley cars, beginning Jan. 1. It is the purpose to serve Elkhart, Mishawaka and a number of intermediate points.

COMPANIES CONSOLIDATE.—The General Electric & Power Company, Connersville, has absorbed the Connersville Electric Light Company and a reorganization has been effected. George Griffith, of New York, is president and P. S. Florea, of Connersville, secretary.

THE LONG DISTANCE INDEPENDENT COMPANY, of Indianapolis, has applied for a franchise at Logansport agreeing to connect with any independent company, whether operated by the city or by a company. The New Long Distance Company is building a line between Marion and Kokomo, and Logansport will be reached next.

MUNICIPAL OWNERSHIP.—The question of municipal ownership of the electric light plant at Richmond at the expiration of the present contract has become the principal issue in the municipal campaign. The men elected to council will have a voice in the settlement of the question, and it is the desire that only men pledged to the scheme be sent to council.

MR. L. E. MYERS, a well known street railway man of Chicago, visited Indianapolis last week. Mr. Myers gained a reputation as a hustler some years ago, when he built during the night, a line through some unplatted ground to connect with some newly annexed territory in Chicago. The residents of the neighborhood opposed the line, but he built it while they slept.

ISOLATED COUNTIES MOVING FOR ELECTRIC RAILWAYS.—Brown, Ohio and Switzerland counties are without railway facilities. The Cincinnati & Aurora Electric Railway Company is building a line to Rising Sun, in Ohio County, and enterprising citizens in Switzerland County have encouraged the company to extend the line along the Ohio River to Madison.

THE SOUTHERN INDIANA TELEPHONE COMPANY has completed its line to North Vernon. One year ago a telephone was a novelty in this part of the state. Since that time 100 miles of line have been built, and the company is increasing its mileage every day. The rapid growth of this enterprise has placed the counties of Ripley, Ohio, Switzerland and Jennings in direct communication with the world.

TELEPHONE FRANCHISE GRANTED.—After weeks of discussion and investigation the city council of Kokomo on Nov. 6 passed an ordinance granting a 15-years' franchise to the New Long Distance Telephone Company. No continuing bond is exacted, but it is provided that should the new company sell out or acquire the interest of the competing company, its property here reverts to the city. The maximum rates are two-thirds of the present charges.

TELEPHONE CONFERENCE.—A conference was held last week at Logansport between the members of the council and General Superintendent Vail, of Indianapolis, and General Solicitor D. G. Richardson, of Chicago, as representatives of the Central Union Telephone Company. The result of the conference is not given out, but it is generally believed that the Central Company will absorb its competitor, the independent plant, and endeavor to establish a rate for one service at about the combination rate for the two.

THE AUTOMOBILE TRUST.—On being interviewed concerning their reported connection with the Anglo-American vehicle combine the Studebaker Brothers, of South Bend, said that they have not as yet entered the combine, but were keeping in close touch therewith to discover if it is to their interest and that of the general public to engage in the manufacture of automobiles, which is the alleged leading object of the combination. It is the intention of the Studebakers to manufacture automobiles, but they prefer to await developments, not only in the good roads movement, but in the perfection of the automobile.

Milwaukee, Wis., Nov. 18, 1899.

A 15-YEAR FRANCHISE for electric light has been granted to C. Behuke & Son by the city of Bullion, Wis.

CHANGING TROLLEY POLES.—The Milwaukee Ellectric Railway & Light Company is taking out all of the centre poles on its lines, where the franchise will allow, and replacing them by side poles.

FRANCHISE ANNULLED.—The franchise of the Kaukauna Electric Light Company has been annulled by the council because the ordinance requiring that the company at once place its wires underground has been disregarded.

THE AUTOMOBILE COMPANY, which is to establish a plant in the Wisconsin Central's vacant shops at Stevens Point is to be capitalized at $6,000,000 and will employ from 200 to 400 skilled mechanics in wood, iron and electric work.

MR. JACOB CLOOS, of Cloos Bros., is consulting engineer for an electric power and light plant for the O'Neil Oil & Paint Company. The Milwaukee Electric Company has the contract for the machinery. Messrs. Rohn & Meyer have the contract for the switchboard and wiring.

TO MANUFACTURE AUTOMOBILES.—President Charles Abusch, of the Charles Abusch Company, states that he has decided not to join with any other combinations or companies for the manufacture of automobiles, but would go into the business as an independent concern. The Abusch Company has been negotiating to join a Michigan corporation, capitalized at $5,000,000, for the manufacture of automobiles, and it was recently reported that this plan had been dropped and that it had been decided to join another corporation, with a capital of $1,000,000.

Minneapolis, Minn., Nov. 17, 1899.

OFFERS TO PAY FOR A FRANCHISE.—A new electric light company has volunteered to donate to Minneapolis 1 per cent. of its gross earnings in return for franchise privileges. The proposition has been referred.

DARKNESS IN MADISON.—Municipal ownership of electric lighting plants has its disadvantages even in places where the idea is strongly advocated. On Nov. 10, Madison, Minn., was in darkness as the result of the council's action in discharging the manager of the electric light plant.

TELEPHONE EXTENSION.—The Northwestern Telephone Exchange Company, of Minneapolis, has decided to extend its line from Crookston, Minn., to the international boundary and connect with the line already built to Pembina. The circuit will be connected with St. Paul and Minneapolis.

THE BENTON POWER & TRACTION COMPANY, of St. Cloud, Minn., has built a power house and purchased two generators of 80 and 100-kw capacity. A 13 x 12 Ideal engine, and boilers are being set up. Besides doing a general electric lighting business the company will furnish power for the St. Cloud street railway.

WATER POWER DEVELOPMENT.—St. Paul hopes soon to realize on a scheme for the development of a water power at Taylor's Falls on the St. Croix River. The river is considerably narrower at that point than the Mississippi is at Minneapolis, yet with a head of nearly 80 feet, it is expected that two-thirds as much power can be developed as at St. Anthony's Falls, or a maximum of about 10,000-hp. It will be necessary to transmit the power 50 miles to be available in either St. Paul or Minneapolis.

St. Louis, Mo., Nov. 18, 1899.

VICTORY FOR THE DAY LINE.—The city council of East St. Louis this week passed an ordinance, permitting the Day line to use certain streets already covered by the East St. Louis Electric Railway. There has been a severe fight for many months for the passage of this ordinance.

DECATUR-SPRINGFIELD ELECTRIC RAILWAY.—Plans were laid this week at Decatur for the construction of an electric railway between Decatur and Springfield. An engineer will be secured to make a preliminary survey and estimates of the cost of the road. It is thought that $300,000 will build and equip the line. The distance between the two cities is 38 miles.

TELEPHONE IN CARLINVILLE, ILL.—A petition for the granting of a 20-year franchise to the Carlinville Telephone Company has been introduced into the city council. The company offers 10 telephones free to the city and $100 per year, provided no other telephone service is used by the city. A petition for a franchise was also asked by the Whitely, Jr., & Fletcher Company for a telephone franchise. They agree to furnish the city five free telephones and two additional if necessary and pay the city 15 cents for each pole set in the streets under certain conditions.

BROADWAY CABLE DEAL.—The long-talked-of deal between the minority stockholders of the St. Louis Railway or Broadway Cable and the Brown Bros. syndicate has been practically completed and the formal transfer of the stock will be made in a few days. Although the exact terms of the deal could not be learned, one of the stockholders said that the stock of the St. Louis Railway would be exchanged for United Railways Company's stock on a basis of 150 for the Broadway stock, but no cash would be paid. By this deal the remainder of the stock of the St. Louis Railway, amounting to about 6000 shares, now held by the minority stockholders' pool, will pass into the hands of the United Railways Company.

San Francisco, Cal., Nov. 13, 1899.

CHANGE TO ELECTRIC TRACTION.—The Market Street Railway Company has suspended street car traffic on Howard Street, from Tenth east to the Ferries, for the purpose of changing the road to an electric line. Numerous improvements have been made in the service on the company's lines.

ELECTRIC RAILWAYS AT SAN JOSE.—An electric railway from San Jose, Cal., to its seaport, Alviso, is to be commenced at once and completed next May. The Standard Electric Company is expected to supply the current. A franchise will be asked for a 30-mile electric road from San Jose to Gilroy.

ELECTRICITY IN A COAL MINE.—Preparations are being made by Superintendent H. S. Huson for the installation of the electric machinery, which will operate the Fairfax coal mine near Tacoma, Wash. The water-power electric transmission plant will operate the mining works and a double track electric road extending into the mine. The mine will have an output of 1000 tons per day to begin with.

ELECTRIC POWER ON THE COMSTOCK LODE.—The cheap power committee, acting for 27 mining companies operating on the Comstock Lode in Nevada, has just made its second payment, amounting to $20,000, to the Truckee River General Electric Company. According to the agreement $100,000 will be advanced in installments at certain periods to the electric company and the money is to be rebated to the mining companies, in payment for power after the plant is in operation. Surveys have been made for the pole line and the flume and ditch are being staked out.

SOUTHERN NOTES.

Memphis, Tenn., Nov. 14, 1899.

MR. L. P. CURTIS, manager of the People's Telephone Company of New Orleans, has been in the city for several days wrestling with the city council over matters pertaining to the new Memphis Telephone Company. The franchise granted required this company to commence work on Nov. 15, but on account of the city council not having decided on a method of conducting the underground work, the time has been extended four months. This virtually stops the work for 12 months, for the reason that the board of health of this city will not permit the streets or alleys to be torn up after the 1st of March.

THE SOUTHERN INDEPENDENT TELEPHONE ASSOCIATION is making preparations for a large attendance at the convention to be held here

the day following Mardi Gras. A room will be provided for the display of apparatus used by the members, and addresses will be delivered by several gentlemen. Mr. C. W. Bolton, the secretary, is preparing a paper on "Long Distance Construction, the Advantage of Bridging Bells and Multiple Instruments," etc. Mr. T. D. Young will read a paper on the "Laws of the Southern States Governing Telephone Lines, Rights of Way etc., and the Importance of Incorporating."

THE MEMPHIS STREET RAILWAY COMPANY is about ready to begin the construction of a mammoth car barn which will cost $100,000. The new structure will be of steel, stone and brick throughout. The offices of the company will be located in the new building, besides the carpenter and paint shops, blacksmith shop, the winding room, the stock department and all other departments which should be for conveniences' sake near to or under the same roof as the car barn. The new building will have nearly three acres of roof and there will be more than a mile of steel rails inside of it for the accommodation of cars. It will cover an area of 436½ feet by 320 feet, and it is expected it will be completed by the 1st of January.

Austin, Texas, Nov. 16, 1899.

THE TROUBLES OF AUSTIN'S MUNICIPAL PLANT.—Recent heavy rains along the course of the Colorado River have replenished the water supply in Lake McDonald and the municipal electric light and power plant at Austin, Texas, has resumed operation. The waters of the lake are again receding, however, and it is feared that it will be but a short time until another shutdown of the plant will be necessary. No definite action has yet been taken looking to the purchase of an auxiliary steam power plant by the city.

CHARTER REFUSED AN ELECTRIC COMPANY.—A company was recently organized at Wharton, Texas, for the purpose of constructing and operating an electric light, ice and cold storage plant. The capital stock of the company was $25,000, but when application was made to the secretary of state for a charter the latter refused to issue it on the grounds that the corporation had the semblance of a trust. The company will appeal to the court for a mandamus to compel the secretary of state to issue the charter.

CANADIAN NOTES.

Ottawa, Ont., Nov. 18, 1899.

WINNIPEG, MAN.—The Bell Telephone Company has decided to build a long distance line between Winnipeg, Portage la Prairie and Neepawa.

A NEW ELECTRIC COMPANY has been formed in Dutton, Ont., for the purpose of supplying light, heat and power. The Canadian General Electrical Company is supplying all the electrical apparatus, transformers and wiring. The initial order is for a 30-kw single-phase alternator.

LEVIS, QUE.—The council is about to construct an electric light system, and invites plans for same. These plans are to be received by Jan. 1; the first prize will be $1000 and the second $500. Particulars may be obtained from Flavne Roy, secretary-treasurer of the municipality.

TELEPHONE CABLE LAID.—A submarine cable was successfully laid across the St. Lawrence River on Nov. 15, between Prescott and Ogdensburg, by the Bell Telephone Company. The cable is one mile and a half in length, contains six conductors and weighs 20,000 pounds.

THE TRENT RIVER PAPER COMPANY, of Frankfort, Ont., has placed an order with the Royal Electric Company for a 40-kw S. K. C. two-phase generator, with transformers and supplies. It is the intention of the Paper Company to not only light its own large premises, but also Frankfort, one mile distant; Stirling, nine miles distant, and Foxboro and Wooler, six miles distant.

WIRELESS TELEGRAPHY IN LABRADOR.—Mr. Chapman, of Montreal, has been in Ottawa on business with the department of public works, with a view of the Dominion government adopting the Marconi wireless telegraph system between the Labrador coast and the island of Belle Isle, where the steamship Scotsman was wrecked. The system may also be extended to Sable Island.

THE RAGGED RAPIDS' POWER DEVELOPMENT.—There has been great delay in the power development works at Ragged Rapids, Ont., by the breaking way of the temporary dam. Supplies cannot be brought in until the temporary dam is in position. The contract calls for the completion of the works by Dec. 1.

THE NIAGARA CENTRAL RAILWAY COMPANY has commenced the conversion of the road between St. Catherines and Niagara Falls into an electric line, and it is expected that cars will be running by Jan. 1. The cars are being built by the Ottawa Car Company, and will be 50 feet long, with baggage and smoking compartments and accommodation for 48 passengers. They will be heated by steam, supplied with Nightingale air-brakes and will rest on double trucks.

THE AUTOMOBILE is to penetrate as far north as Cariboo and Omineca. B. C. In Vancouver, at Armstrong & Morrison iron works, a motor stage coach is now being built, to be operated on the Ashcroft-Cariboo road. An American company is also applying for incorporation at the next session of the British Columbia legislature for the purpose of building a road into the Omineca district, to operate automobile and other vehicles for passenger and general transportation business.

ELECTRIC RAILWAY IN DEMARARA.—Canadian capital and energy is again showing the way in the construction of electric roads in different sections of the world. The organization of the Demerara Electric Company has been effected for the purpose of building an electric system in the city of Georgetown. Mr. W. B. Chapman, of Montreal, has been working upon the project for some time, and it is believed that the present venture will duplicate the success which has been attained by him in other parts of the tropics. Mr. Frank Brothers, of Montreal, has been appointed superintendent of construction. Some 12 or 14 miles of track will be laid this winter, and it is expected that the entire road will be in operation within seven or eight months.

General News.

THE TELEGRAPH AND TELEPHONE.

MILLVILLE, N. J.—The Millville Telephone Company has connected its line with Ocean City.

WILMINGTON, N. C.—The Interstate Telephone & Telegraph Company is building a line from Wilmington to Lumberton.

BLACKSTOCK, S. C.—The Blackstock Telephone Company has been incorporated with a capital stock of $300. The incorporators are Alexander McDonald, William McKinnell and John Bell.

HUMBOLDT, TENN.—The Gibson County Telephone Company has been incorporated with a capital stock of $20,000 by E. N. Mendenhall, V. T. Grizzard and J. T. McKibbon, and others.

DOVER, DEL.—The Central Telephone & Telegraph Company was chartered here, with a capital stock of $125,000. The incorporators named are W. D. Barnard, Philadelphia; William C. Mayne, Bristol, Pa., and Gardner W. Kimball, Wilmington.

RED LODGE, MONT.—The Red Lodge & Wyoming Telephone Company has been incorporated to construct and operate a telephone line. Capital, $10,000. Incorporators: B. E. Vaill, J. L. Robbins, W. A. Talmage, all of Red Lodge.

CHIPPEWA FALLS, WIS.—Farmers in the town of Eagle Point are organizing a new telephone stock company to build a line to this city, where a central exchange will be put in. It is the intention of the new company to take in capital from this city and extend the line to other places.

SHELBYVILLE, KY.—The Shelbyville Telephone & Telegraph Company has been incorporated to build a telephone line from Shelbyville to Taylorsville. The capital stock is $5000. Mr. S. S. Kirk is president; J. J. Downey, vice-president; W. N. Harrison, secretary; T. B. Beard, treasurer.

BALTIMORE, MD.—The property of the Baltimore, Annapolis & Drum Point Telephone Company will be transferred in 10 days, it is said, to the Chesapeake & Potomac Telephone Company. The consideration is understood to be $11,500. The newly organized property will add 70 miles to the service of the Chesapeake & Potomac Company.

BUFFALO, N. Y.—South Buffalo business men are highly pleased by the information that the Bell Telephone Company will take out all its old telephones in that section of the city. The instruments will be replaced by long distance telephones at a cost of $24 for 400 messages. A new telephone exchange will also be established at Triangle street and Abbott Road.

SUBMARINE TELEPHONY.—Thomas A. Edison, Jr., and William Holzer believe that they have invented an apparatus by which the submarine cables can be used as telephone wires and conversation carried on between New York and London. Arrangements are being made for a test over the Haytien Cable Company's wires about the end of December.

BELOIT, WIS.—Circuit Judge B. F. Dunwiddie has rendered a decision that the Wisconsin Telephone Company cannot erect poles and string wires in highways without the consent of property owners. The corporation attempted to do this in Beloit last spring, but was restrained by an injunction issued by Court Commissioner Dow in behalf of William B. Strong, ex-president of the Santa Fe Railroad, who owns large property interests here. The case will be appealed.

RIDGWAY, PA.—Many Ridgway people who signed papers stating that they would become patrons of the new telephone company that was to locate here, are wondering what has become of the concern. An ordinance permitting it to erect poles, etc., in the borough was passed by the council some time ago and the officers of the company promised that work would begin at once. That was several months ago, and no definite move has been made and the signers want to know why.

THE WESTERN ILLINOIS TELEPHONE ASOCIATION was organized at Carlinville, Ill., on Nov. 1. The object of the association is to enable the members to become better acquainted among themselves, and to bring about interconnection between their lines. They will also endeavor to induce new companies to open up new fields in the independent telephone business all over the state. The members will assist each other and furnish aid and information to new inexperienced members. Dr. I. A. Lumpkin, of Mattoon, Ill., is president, and James A. Fletcher, secretary.

ELECTRIC LIGHT AND POWER.

ROANOKE, VA.—The Roanoke Railway & Electric Company will expend about $100,000 for general improvements to its system.

PAINT ROCK, ALA.—The Paint Rock Milling Company will remove its flour mill to Gurley and put in an electric light plant.

TUSCUMBIA, ALA.—Birmingham and Tuscumbia gentlemen have been granted a franchise to establish an electric light plant and water works in this place. The Mayor can give further information on the subject.

HOWARD CITY, MICH.—The Howard City Electric Light Company has decided to rebuild its plant, which was burned some time ago, and expects to have it running in about thirty days.

ELECTRIC LIGHT INVESTIGATION.—There is dissatisfactinon with the street lighting service rendered by the Columbus Electric Light Company, Columbus, Ohio, and a committee appointed for the purpose is now investigating the matter.

AUBURN, ILL.—The Auburn Electric Light Company, which was recently organized, will require a complete equipment for a plant of 1000 lights capacity. The company will require an alternator of this size, a 35-light arc machine, engines, boilers, etc. Mr. W. H. Ramsey is secretary.

COLUMBUS, O.—The Belmont Electric Light & Power Company, of West Virginia, was admitted to do business in Ohio, under the foreign corporation

act. Its capital stock is $100,000, and all of it is employed in Ohio. It is virtually an Ohio company, located at Bellaire.

NORFOLK, VA.—The Norfolk Electric Company, P. Warrington, president, capital $300,000, was chartered. It will compete with the present company here, and will furnish light to individuals and possibly to the municipality. Philadelphia capitalists are interested.

WAYNETOWN, IND.—Mr. E. S. Aldrich, of Westerville, Ohio, has purchased the electric light plant here. He will make some improvements and give a morning service. Many new buildings will be wired, and additional lights will be put in at once. The plant is operated on the series T. H. arc and alternating current incandescent systems.

NORWICH, N. Y.—The Norwich Gas & Electric Company, with a capital stock of $100,000, has filed articles of incorporation. The directors are Edward L. Smith, Floyd Kiser, Charles P. Welles, N. N. Betts, of Tonawanda, Pa.; John Throop, of Norwich; Robert E. Drake, of Syracuse, and Selwyn N. Blake, of Elmira.

CHARLOTTE, N. C.—Local capitalists, interested with New York and Baltimore men in the purchase of the Mountain Island water-power on the Catawba River, announce that the $300,000 option on the property will be taken up. The purpose is to furnish power by electric transmission, and it is thought that the plant can be developed to 20,000 horse-power. The projectors may build several cotton mills in this vicinity.

THE ELECTRIC RAILWAY.

SHELBURNE, VT.—The Hinesburg Railway Company, of Burlington, it is reported, contemplates the construction of an electric railway from Burlington to Shelburne.

OIL CITY, PA.—The Citizens' Traction Company has been organized here with a capital stock of $150,000. Mr. D. J. Geary is president, and James Hasson, treasurer.

CLINTON, N. Y.—The Clinton Company has been incorporated to furnish gas and electricity; capital, $50,000. Directors: John N. Williamson, Bone Park; Thomas W. Cantwell, Albany; Thomas F. McBride, and James L. Dempsey, Clinton.

REYNOLDSVILLE, PA.—The Reynoldsville Electric Company has been organized to supply Reynoldsville with electricity for lighting, heating and power purposes, capital, $75,000.

INDIANAPOLIS, IND.—A Greenfield firm has secured the contract to build the power house of the Indianapolis & Greenfield electric road at Greenfield. It must be ready for operation by April 1, 1900.

WAREHAM, MASS.—The Boston & Cape Cod Street Railway Company, which was recently incorporated with a capital of $75,000, will build a road 20 miles in length. All of the material for the work is yet to be purchased.

DENVER, COL.—The Denver & Southwestern Railway Company has been incorporated in Delaware with a capital of $5,000,000. Incorporators: Henry Ware, of Brookline, Mass.; James L. Wolcott, James Virdin, of Dover, Del.

FORT WAYNE, IND.—The Fort Wayne Traction Company has been incorporated with a capital stock of $2,000,000. The company will operate electric lines in Fort Wayne and on roads radiating from this city. The directors are John H. Bass, George A. Garretson, H. P. McIntosh, James Parmelee, J. H. Wade, H. P. Eells and E. H. Bourne.

GALVESTON, TEXAS.—The city council has granted an ordinance to consolidate the Galveston Street Railway and the line belonging to the Gulf City Railway Company. It is stated that the new company will build several extensions, which will be operated on the trolley system.

REYNOLDSVILLE, PA.—Bids are wanted by the Reynoldsville Electric Company for electric light apparatus. The plant is to cost about $20,000, and will have a capacity for 60 2000-cp arc and about 3000 16-cp incandescent lights. A trolley line 16 miles in length will be built in the spring.

BEDFORD, N. Y.—The directors of the newly incorporated Bedford & Eastern Railway Company have asked the highway commissioner of Bedford for a franchise to run their line through the five miles of the town. The road's ultimate purpose is to parallel the New York and Harlem Railroad from White Plains north into Connecticut, and also strike westward to Peekskill.

McKEESPORT, PA.—The Versailles trolley line, which runs from McKeesport to Buena Vista, on the Youghiogheny Valley, has changed hands. The line is about seven miles long. It is believed the promoters of the Irwin and McKeesport road are the buyers. The Mellons, of Pittsburg, are said to be back of the company. Improvements are to be made and the road extended to West Newton.

NEWARK, N. Y.—There is an opening for the building of a street railway in a village nine miles from this place. It has a population of about 800, and has no street railway facilities. There are several factories in the place, and it is in a live agricultural section. There is every promise that an enterprise of this character will be successful. Messrs. W. C. and F. D. Burgess, of this place, are interested in the scheme and can give further information.

COUNCIL BLUFFS, IOWA.—The Omaha, Council Bluffs & Suburban Railway Company, which was organized last month in Iowa, is officered by the following named gentlemen: George Townsend, president; W. S. Reed, secretary; F. F. Espenschied, treasurer and vice-president. The length of the line will be 18 miles. The company will run 20 motor cars and 10 trailers, the cars being built by the Jewett Car Company. Peckham trucks will be used.

AKRON, OHIO.—The Barberton village council was interrupted in the middle of its proceedings by Sheriff Kelly, who served an injunction restraining the council from repealing a franchise recently granted the Akron & Cuyahoga Falls Rapid Transit Company. The company got into a quarrel with the council, which proposed to repeal the franchise to punish it. A vote was about to be taken on the final reading of the repealing ordinance when the sheriff stopped the proceedings.

PONTIAC, MICH.—It is now announced here that the Detroit & Northwestern electric railway will be completed and cars will be running between this city and Detroit by Dec. 1. Since Oct. 1, 10 miles of track have been laid and a gang of 150 men are still at work. There is now less than five miles of iron to be laid. The power house and car barns are located at Farmington, and from that place to Detroit a double track will be laid.

WICHITA, KAN.—Judge Dale, of the district court here, granted a permanent injunction restraining the Wichita Street Railway Company from operating its plant and ordering all the cars and track from the streets. The injunction was asked as a last resort by the mayor and city council to get a new system of street railway. A company with $200,000 capital was organized two months ago and given a franchise by the city council to build a new line, but the old company refused to surrender the streets.

OIL CITY, PA.—The Citizens' Traction Company has been organized here by the election of the following officers: Daniel J. Geary, president; Captain James Hasson, treasurer; F. W. Bowen, secretary; and the following directors: D. J. Geary, H. I. Beers, Eugene Liebel, D. T. Borland, Amos Steffee and P. C. Boyle. The capital stock is to be $150,000, of which $134,000 has been taken. The franchise was granted to this company by the city council several weeks ago and a charter is to be applied for at once.

HEMPSTEAD, L. I.—The trustees have granted a franchise to the Mineola, Hempstead & Freeport Traction Company to operate a road through the town. The Nassau Belt Line had an application pending, and an effort was made by the officials of the company to have the trustees decide in their favor, but no action was taken regarding their application. The Mineola, Hempstead & Freeport Traction Company will begin work, it is said, within 10 days. President Newton, of the Mineola Company, says it is the intention to connect with the North Shore trolley line.

LANCASTER, PA.—The trolley system of the Pennsylvania Traction Company, which has been in the hands of a receiver the past three years, was sold on Nov. 15, under a decree of foreclosure, issued at the instance of the Provident Life & Trust Company, of Philadelphia, trustee for the bondholders. The property was purchased for $205,000 by W. B. Kurtz, of the Philadelphia banking firm of W. W. Kurtz & Co., for the newly organized Conestoga Traction Company, subject to underlying bonds to the amount of $660,000. The new owners intend building several new lines of road in various parts of Lancaster County and to eventually have trolley connection with Philadelphia and Reading. The roads just sold were originally capitalized at $2,225,000.

ELIZABETH, N. J.—On Nov. 16 the city council accepted the ordinance of the Westfield & Elizabeth Street Railroad Company and granted it a franchise to operate a trolley line on Jersey Avenue into Elizabeth. The line will use the tracks of the North Jersey road from the head of West Jersey Street to Broad to the union station of the Pennsylvania and Central railroads, and has been constructed from Plainfield through Westfield, Scotch Plains, Fanwood and Cranford, at which latter place, because of the refusal of the Central Railroad, it will be forced to make passengers walk across the track until next spring, when an overhead structure will be built. The company agrees to give the city of Elizabeth 2½ per cent. of its gross receipts for the first five years, and 5 per cent. after that, annually, and agrees to pave Jersey Avenue.

NEW COMPANIES.

THE KINGSLAND FRICTION CAR BRAKE COMPANY has been incorporated at East St. Louis, Ill.; capital stock, $10,000. Incorporators: Corwin H. Spencer, Lawrence D. Kingsland, William H. Thomas.

THE RAILWAY INVESTMENT TRUST, of New York, has been incorporated at Dover, Del., to purchase and sell stocks and bonds of railway and other corporations; capital, $500,000.

ELECTRIC CAR LIGHTING & VENTILATING COMPANY, of Portland, Me., has been incorporated to manufacture and deal in electrical and mechanical apparatus. Capital, $500,000. Incorporators: C. H. Morse, W. M. Chapman, of Cambridge; C. W. Richards, of Needham.

MANCHESTER, N. H.—The Consolidated Electric Company, of this city, has been incorporated with a capital of $250,000. The incorporators are Eugene S. Whitney, of this city; Thomas H. Armstrong, of Waltham Mass., and Arthur E. Mason, Franklin L. Joy, E. W. Kellogg and Frank E. Brown, of Boston. It is the intention of the company to utilize the water power at Garvins Falls, 12 miles north of this city, for the purpose of generating and supplying electricity for lighting, heating and power. It is anticipated that the Merrimac Lighting, Heating & Power Company of Hooksett, will be consolidated with the newly incorporated concern, and that power will be supplied the Manchester street railway, and many industries in this city and at Hooksett.

PERSONAL.

MR. E. H. MULLIN, of the General Electric Company, has been recuperating after a season of hard work by a brief trip to Bermuda.

MR. BION J. ARNOLD, of Chicago, has been east on a professional trip, having some important consulting engineering work on hand at Providence, R. I.

MESSRS. POLLAK & VIRAG, whose high speed machine telegraph system has been described in these pages, are now in this country, on a visit from Budapest, to undertake tests and sell their patents for the United States. They go to Chicago.

MR. H. J. RIFFEL, favorably known in connection with the Siemens & Halske people, has severed his connection with that concern to join the already large staff of the Belknap Motor Company, of Portland, Me. The Belknap Motor Company is fortunate in securing Mr. Riffel's services.

MR. MILTON PLAYER has been appointed superintendent of the Electric Axle, Light & Power Company, New York, in place of Mr. G. K. Wheeler.

and Mr. H. K. Brooks has been appointed mechanical engineer of the same company. Both Messrs. Player and Brooks will have their headquarters in Topeka, Kan.

MR. RUSSELL THOMAS KINGSFORD, for some time chief engineer of the American Impulse Wheel Company, has resigned that position and is now chief engineer of the Rushmore Dynamo Works, of Jersey City. Mr. Kingsford is a graduate of Stevens Institute of Technology and has had extensive experience in designing dynamo machinery. Mr. Kingsford will assume entire charge of the building of the large multi-circuit arc machines, relieving Mr. Rushmore, who will hereafter give his time mostly to his rapidly increasing searchlight and optical business.

LEGAL.

A TROLLEY LINE A RAILROAD.—A decision has been rendered by the New Jersey Supreme Court in the case of the Hoboken Railroad, Warehouse & Steamship Connecting Company, which appealed from the taxes levied against it by the municipality of Hoboken. The company claimed that it was a railroad company, and that consequently it should be assessed by the state board of assessors at the low railroad rates, instead of by Hoboken at the local rate. It is operated as a trolley line, and carries freight between the Erie Railroad at Weehawken and the Hoboken steamship piers. No passengers are carried. The Supreme Court decides that the fact that the company uses a trolley line does not invalidate its claim to being classed as a railroad corporation, and that, therefore, it is taxable by the state board of assessors.

Trade and Industrial Notes.

INDUCTION SEWING MACHINE MOTOR.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 3008, which illustrates and describes the method of attaching its induction motor to family sewing machines.

THE FEDERAL BATTERY COMPANY, of New York, which manufactures "Federal Salt" and "Federalite" for batteries, are finding a largely increasing demand from all parts of the country for its salts, the telephone business being especially heavy.

THE FOOS GAS ENGINE COMPANY, of Springfield, Ohio, purchased the extensive plant of the Whiteley Manufacturing Company for $40,000 and will double its capital stock to $200,000. It will occupy the shop Jan. 1 and the intention, it is stated, is to make it the largest gas engine plant in the country.

THE ELECTRIC RAILWAY SWITCH & SUPPLY COMPANY, Springfield, Mass., announces that it has completed arrangements with Messrs. Robert Gowdy & Co. to act as its selling agents. Mr. L. L. Davies will continue in the active management of the business and everything connected therewith will continue as heretofore.

THE GARLOCK PACKING COMPANY, Palmyra, N. Y., reports that its business of this year far exceeds that of any other year in its history. The company's two factories, at Palmyra, N. Y., and Rome, Ga., are being run to their full capacity, and have been operated nights recently, in order to enable the company to fill orders promptly.

TELEPHONE CABLES.—John A. Roebling's Sons Company, Trenton, N. J., has issued a pamphlet on telephone cables and their equipment and installation. The various types of telephone cables are described and illustrated, and the devices used in their installation are also shown and briefly described. The little pamphlet no doubt will be valuable to those interested in telephony.

THE PERFECT ARC LAMP & MANUFACTURING COMPANY, of Brooklyn, has been incorporated at Albany, with a capital stock of $100,000. The directors are Charles Hagerdown, Robert Ward, Bernard H. Pomeroy, James C. Lavelle and Walter L. Bulmer, of Brooklyn, and Lewis Sylvester, of New York City. The object of the company is to deal in general electrical and mechanical devices.

THE GREGORY ELECTRIC COMPANY, 54 South Clinton Street, Chicago, has just received the large Westinghouse alternators purchased from the Missouri Edison Company, of St. Louis, aggregating 40,000 lights capacity. Three of the large 150-kw machines have already been sold by this company and were shipped last week. The Gregory Electric Company purchases entire lighting and power plants, and employs 95 men in its works at present.

MESSRS. CHARLES H. BESLY & CO., 10 North Canal Street, Chicago, Ill., report that their Beloit (Wis.) factory is running overtime in many departments, in order to keep up with the demand for their specialties, which is so great. Their goods are sold not only in this country, but in foreign countries as well, some recent foreign shipments going to India, Argentine, France, Germany, Russia and England. The orders for Helmet oil and Perfection and Bonanza cups, for future delivery, the firm reports, are far in excess of those of previous years.

SENOR MARSICAL SLEPT.—His excellency, Senor Ignacio Marsical, vice-president of the Mexican Republic, in speaking of his trip from Buffalo to New York, by the New York Central, says: "The trip was so comfortable and so fast that I could not help going to sleep and having a good night's rest." Vice-President Marsical has been in the habit of having his train sidetracked at night so as to allow him to sleep, but he found the track of the New York Central so perfect that he had a most excellent night's rest while speeding across the Empire State at over 50 miles an hour.

WESTINGHOUSE RAILWAY MOTORS.—The Westinghouse Electric & Manufacturing Company has issued a handsome pamphlet descriptive of Westinghouse railway motors and also containing illustrations of some typical Westinghouse railway power stations. All of the various new types of Westinghouse machines are illustrated in detail. The improvement in electric railway motors is well illustrated by curves printed of tests of one of the latest types of Westinghouse motors, which shows a sustained efficiency between the limits of ordinary work that but a few years ago would have been considered impossible.

WESTINGHOUSE ELECTRO-PNEUMATIC CONTROLLING SYSTEM.—In a beautifully printed and illustrated pamphlet of 40 pages, issued by the Westinghouse Air Brake Company, the Westinghouse electro-pneumatic system for controlling railway and other motors is described in detail. This system involves the use of compressed air for moving the controlling apparatus, the admission of the air into the several parts being controlled electrically by means of magnets attached to the air valves. The system is especially adapted for the multiple unit train system, in which case a full complement of air-compressing and storage apparatus is employed on at least one car and auxiliary storage apparatus on each motor car. All of the various details are illustrated by extremely well executed engravings.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, realizing that the demand of the independent telephone companies is constantly on the increase for telephones and switchboards of the highest quality, now offer to the public their new 1900 telephone and their Western Express switchboard. The new telephone can be used both for local and long distance work. The company claim that their new Western Express switchboard embodies the newest and latest construction in the switchboard line on the market, and its general construction is claimed to be perfect both electrically and mechanically For rapidity of operation, ease of access to parts for inspection and repairs, freedom from defects causing cross-talk and induction disturbances, great durability and the highest efficiency, it is claimed to be unequaled by any board yet produced. Catalogues and full descriptive matter can be had on application.

CLING-SURFACE.—In a supplementary report dated Oct. 5, 1899, Prof. R. C. Carpenter, of Cornell University, says the later tests made of Cling-Surface on belting substantiate in every particular the statements made in his report of April 17. "They also indicate higher efficiency of transmission and less loss of power in the case of belts treated with Cling-Surface than in the case of belts not so treated, when working under the conditions prevailing at the time of the earlier test. This is due to the fact that the slipping of a belt causes considerable loss of power, the power so lost passing off in heat. The use of Cling-Surface reduces the slipping and consequently reduces the loss of power occasioned by the use of belts that slip. During the past six months I have had occasion to observe the practical use of Cling-Surface in a number of instances. In all such cases Cling-Surface has improved the belts by softening them, and as far as I can determine in the limited time (seven months) tends to preserve the leather of which they are constructed."

PNEUMATIC TOOLS.—With regard to the disputes in the important field of pneumatic tools, we have received the following statement from the Standard Pneumatic Tool Company: On Oct. 16, 1899, we notified the Chicago Pneumatic Tool Company of Chicago, Ill., selling agents for the Boyer pneumatic tools of St. Louis, that they were directly infringing on our letters patent and demanded that they stop selling them and to account to us for all that they had sold up to date. They replied, stating that they would like to purchase our patent, which practically admits infringement on their part. We refused to sell our letters patent and have brought suit against the Chicago Pneumatic Tool Company of Chicago, Ill., and the manufacturers, the Boyer Machine Company, St. Louis, in the United States Circuit Court of St. Louis, for infringement of such letters patent. We manufacture the "Little Giant" hammers under exclusive license obtained from the Choteau Manufacturing Company of St. Louis, Mo. The suit which the Chicago Pneumatic Tool Company have brought against us applies only to the pneumatic hammer. The validity of the patents under which we manufacture all our other "Little Giant" tools and appliances, including drills, boring machines, riveters, rolling machines, blow-off cocks, etc., has never been and is not now under dispute. We entered the pneumatic tool field about three years ago, and our business has increased with remarkable rapidity, which can be attributed to the superiority of our machines. As above stated, we notified the above-mentioned company that they were infringing on our pneumatic hammer patents. They, as a matter of retaliation, entered counter suit against us on pneumatic hammers. We therefore wish to impress upon you the fact that the pneumatic hammer patents only are involved in this suit, and that all our other machines have no connection therewith whatsoever. We stand ready and willing to sign an indemnity bond guaranteeing protection to users of "Little Giant" and other pneumatic tools.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED NOV. 14, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

11,787. ELECTRIC MOTOR; C. R. Meston, St. Louis. App. filed Aug. 21. 1899. (See Current News and Notes.)

636,778. MEANS FOR GENERATING ELECTRICITY FROM CAR WHEEL AXLES; P. Eccleston, Newark, N. J. App. filed April 19, 1899. The dynamo is mounted upon the truck and driven by belt from the axle, mechanism being provided for keeping the belt taut.

636,779. ELECTRICAL BELL RINGER FOR STREET CARS; F. A. Enz and W. H. Fetter, Pittsburg, Pa. App. filed July 6, 1899. A push botton is located in the handle of the controller, by operating which the motorman can ring the warning bell.

636,804. QUICK BREAK ELECTRIC SWITCH; G. L. Holton, Utica, N. Y.

App. filed March 25, 1899. The switch embodies a pair of main blades and a pair of snap blades, one operated by the other.

636,871. CEILING FAN MOTOR; H. H. Wait, Chicago, Ill. App. filed Jan. 16, 1899. The motor and fan blades are mounted upon a chandelier for economy of space.

636,872. TELEPHONE TRUNK LINE SIGNALING; T. C. Wales, Jr., Newton, Mass. App. filed Aug. 17, 1899. (See Current News and Notes.)

636,875. ELECTRIC ARC LAMP; E. P. Warner, Chicago, Ill. App. filed April 1, 1899. The invention comprehends among other details an improvement in the clutch, which consists of two rings of different weight, whereby vibrations will affect them differently, thus preventing both rings being relaxed at the same time.

636,881. ELECTRIC BAND; J. M. Wolkowsky, Irwin, Pa. App. filed April 4, 1899. An electric belt consisting of two sections, one of zinc and the other of copper, hinged together and provided with means for fastening the free ends together.

636,897. ELECTRIC GENERATOR OR MOTOR; C. H. and J. H. Cutting, Derby, England App. filed Aug. 23, 1898. The improvements relate to the field magnet construction; the yoke is provided with a transverse opening and the core of the magnet projects through and is secured in said opening.

636,905. DISTRIBUTING PANEL FOR ELECTRIC CIRCUITS; E. J. Klein, New York. App. filed March 31, 1897. The invention relates to the fuse holders and consists of the details of construction thereof.

636,910. ELECTRIC ALARM SYSTEM; R. R. May, San Jose, Cal. App. filed June 17, 1899. The apparatus includes a battery and a plurality of circuits, one of which contains a number of alarms in multiple arc, and another an electro-mechanical circuit closer adapted to close the alarm circuits when its own circuit is closed through the medium of a push button.

636,937. ELECTRIC RAILWAY; W. Wright, Buffalo, N. Y. App. filed Oct. 31, 1898. A magnet carried by the car acts upon an armature in a conduit and closes the circuits to the sections of a sectional conductor, the invention relating particularly to the details.

636,938. MANUFACTURE OF ELECTRIC BATTERIES; Edward Baines, New York, N. Y. App. filed June 7, 1898. (See Current News and Notes.)

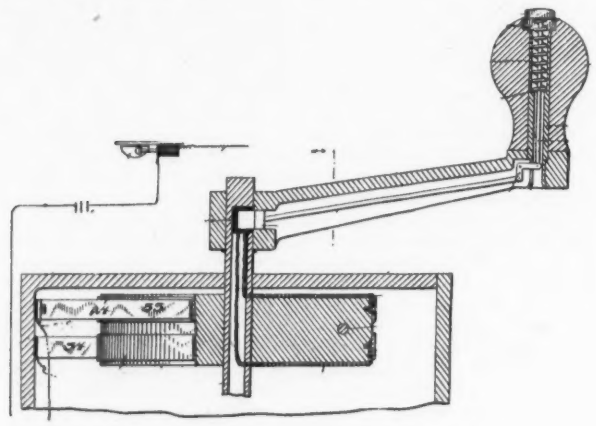
636,956. PROCESS OF MAKING BATTERY CUPS; F. G. Curtis, Everett, Mass. App. filed May 10, 1897. (See Current News and Notes.)

636,989. QUICK BREAK ELECTRIC SWITCH; R. B. Hewson, San Francisco, Cal. App. filed May 17, 1899. A knife switch in which one of the terminals moves with the blade a short distance to store power in a spring, which afterward overcomes the frictional connection between the blade and the terminals and makes a quick separation thereof.

637,006. SYSTEM OF ELECTRIC TRACTION; L. M. Moxham, Boston, Mass. App. filed Feb. 25, 1899. The car mechanically operates a plunger in the roadbed which is thereby caused to connect with the working conductor.

637,012. ELECTRIC BURGLAR ALARM; G. McGann, St. Louis, Mo. App. filed March 21, 1898. The object of this invention is to provide means for testing the condition of the circuits, the invention consisting of the details of the apparatus.

637,057. ELECTRIC IGNITER; C. D. Wright, Chicago, Ill. App. filed July 2, 1898. A tubular handle is connected with a battery and provided with sparking points which act upon an inflammable material carried in a receptacle adjacent to the points.



636,779.—Electrical Bell Ringer for Street Cars.

637,058. ELECTRIC LIGHTING ATTACHMENT FOR GAS FIXTURES; C. D. Wright, Chicago, Ill. App. filed Feb. 27, 1899. A receptacle for the batteries is attached directly to the chandelier.

637,059. COMBINED TYPEWRITER AND TELEGRAPHIC TRANSMITTER; C. E. Yetman, Oak Park, Ill. App. filed Jan. 20, 1899. The invention designs to simplify and improve the machine shown in the same inventor's former patent, No. 565,128, by reorganizing the various features of construction.

637,060. ELECTRIC ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed Nov. 8, 1898. These improvements relate to the construction of the clutch, the lamp casing, the devices carrying current to the upper carbon and other minor features.

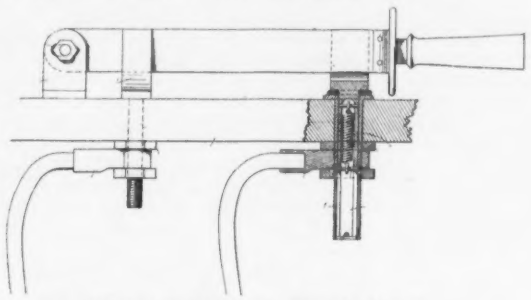
637,071. ELECTRIC BATTERY COMPOUND; Henry Blumenberg, Jr., New York, N. Y. App. filed Dec. 31, 1898. (See Current News and Notes.)

637,072. ELECTRIC BATTERY; H. Blumenberg, Jr., and F. C. Overbury, New York, N. Y. App. filed March 13, 1899. (See Current News and Notes.)

637,096. SAFETY CONTACT INTERRUPTER FOR SUSPENDED ELECTRIC WIRES OR CABLES; R. Ducornot, Puteaux, France. App. filed March 11, 1899. This device is a tube of insulating material closed at both ends by metal stoppers. This tube is filled with mercury and oil and is inserted in the cable at various points. If the cable breaks and falls the mercury all goes to one end of the tube and the oil to the other, thus breaking the circuit at a second point, distant from the locality, where the falling cable rests upon the ground.

637,115. RESIDENCE ELECTRIC PLANT; H. Hise and J. Eckman, Arkola, Ill. App. filed Feb. 24, 1899. The dynamo, engine and regulating devices are all mounted on a single base and so constructed as to be easily portable.

637,119. ELECTRIC RAILWAY; R. M. Hunter, Philadelphia, Pa. App. filed July 20, 1894. (See Current News and Notes.)



636,989.—Quick Break Electric Switch.

637,179. SECONDARY ELECTRIC CLOCK; J. J. Stockall, Sr., London, England. App. filed Sept. 12, 1899. This is a peculiar form of escapement for imparting a step-by-step movement to a clock impelled by an electromagnet.

GERMAN PATENTS, ISSUED NOV. 1, 1899.

[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

104,650. DYNAMO; Chas. Clifton Cowan, Memphis, and Marcy Lelland Whitfield, Chicago. App. filed Nov. 1, 1898. A steam cylinder is mounted upon a common base plate with the dynamo and the sliding bed of the cross head is cut into the metal parts of the dynamo.

105,049. MANUFACTURE OF PHOSPHORUS; Louis Dill, Frankfurt a. Main. App. filed July 16, 1897. This process of continuously producing phosphorus consists in mixing concentrated phosphoric acid of 60 to 80° B. with carbon, submitting this mixture to the action of the electric current and renewing from time to time the said mixture of carbon and phosphoric acid. The electric current decomposes the phosphoric acid and the carbon increases the conductivity of the acid and supports the chemical process.

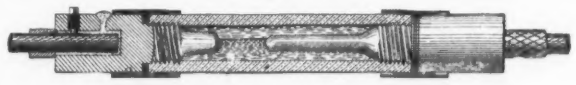
104,588. TROLLEY PULLEY; S. H. Short, Cleveland. App. filed April 8, 1898. The pulley is provided with a hollow axle, which serves as the oil container. Two contact pieces are located in this axle, which by means of a steel spring are pressed against the running face of the pulley, thereby insuring perfect contact.

104,711. TROLLEY PULLEY; Emil Wohlfeld, Hamburg. App. filed Oct. 5, 1897. The trolley pulley is pivotedly connected to the upper end of the trolley pole by means of a two-armed lever. One or two separate pulleys are provided below and sideways of the trolley pulley. These pulleys run in a second lever which is raised, as soon as the trolley pulley leaves the trolley wire, so that one of the auxiliary wheels will come in contact with the wire, which immediately will give off its place to the trolley pulley.

104,714. ELECTRIC BRAKE; A. Wilde, Hamburg. App. filed Oct. 27, 1898. (Addition to patent No. 95,843 of March 30, 1897.) A number of exchangeable pole shoes are provided between the coils, instead of the protruding edges of the coils previously used. The end pole shoes may be constructed as a brakeshoe or brake roller, to act against the car wheels.

104,776. ROTARY INTERRUPTER; Daniel McFarlane Moore, Newark. App filed May 17, 1898. The interrupter wheel is located within an evacuated space and is actuated upon by a field magnet located exterior of said vacuum. The contact brushes sliding on the wheel are pressed against the same by means of an electromagnet also located exterior of said vacuum.

104,777. VIBRATING INTERRUPTER; Daniel McFarlane Moore, Newark.



637,096.—Safety Contact Interrupter for Suspended Electric Wires or Cables.

App. filed May 17, 1898. The anchor of the interrupter has the form of a beam of scales. This anchor is pressed against the contact point by means of a permanently agitated electromagnet, which acts against a second only temporarily agitated electromagnet.

104,940. DEVICE FOR SIMULTANEOUSLY OPERATING THE SWITCHES OF A NUMBER OF MOTOR CARS; Siemens & Halske, Berlin. App. filed May 27, 1898. Synchronous auxiliary motors are provided on the motor cars, which by means of suitable electromagnetic couplings may be actuated upon from one point, for instance, the engine cabin, and may operate simultaneously and in the same measure upon the current controllers of the car motors.

105,054. ELECTROLYTIC APPARATUS; Max Haas, Aue. App. filed Nov. 6, 1898. The apparatus consists of a number of compartments separated by electrode plates and is used especially for making bleaching fluids. In order to increase the circulation of the liquid, apertures are provided in the electrodes alternately in the centre and on the sides, whereby a double zigzag circulation is induced.

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No. 2861.

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Manhattan Electrical Supply Co.
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Non-Polarizing Dry Battery Co.
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Stirling Company, The.

BOILER COMPOUNDS.
Dearborn Drug & Chemical Co.

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Hartford Steam Boiler Ins. Co.

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Speer Carbon Co., The.
Wirt & Co., Charles.

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Standard Underground Cable Co.

CABLING MACHINES.
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Gold Street Car Heating Co.
Simplex Electrical Co.
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Columbian Elec. Car L't'g & Brake Co.
Electric Axle Light & Power Co.

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CIGAR LIGHTERS, ELECTRIC.
Abbott Electric & Mfg. Co.

Continued on Page 42.

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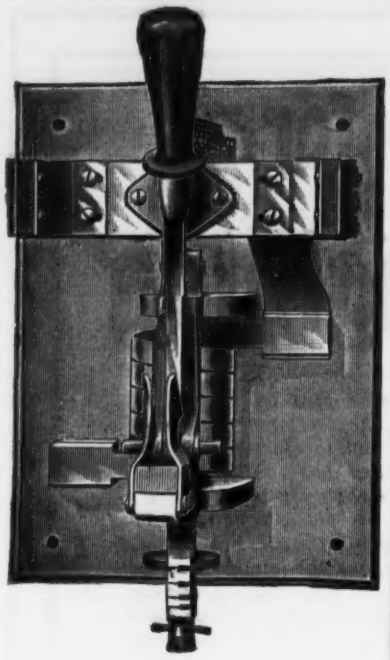

We believe there is not an important IRON or STEEL plant in the United States in which our CIRCUIT BREAKERS are not used. The I-T-E CIRCUIT BREAKER is peculiarly adapted, by reason of its superior mechanical and electrical construction, to the severe requirements of these and kindred industries. THE LORAIN STEEL COMPANY, in a communication under date of November 16th, write us relative to Circuit Breakers, and closed their letter by saying, "We have had excellent satisfaction with your Circuit Breakers which are in use in our Welding Equipments and have seen the hardest kind of continuous service."

This is what our customers have a right to expect.

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CLASSIFIED INDEX.—*Continued from Page 41.*

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La Roche & Co., F. A.
Ward Leonard Electric Co.

CLIMBERS.
Klein & Son, Mathias.

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Hunt Co., C. W.
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Link Belt Engineering Co.

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Johns Mfg. Co., H. W.

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McLennan & Co., K.

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Marshall, Wm. (Electric).

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Michigan Pipe Co.
National Conduit & Cable Co.
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Moore, Alired F.
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Jenney Electric Mfg. Co.
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Pelton Engineering Co.
Ridgway Dynamo & Engine Co.
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Victor Electric Co.
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Warren Electric Mfg. Co.
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American Electrical Heater Co.
Gold Street Car Heating Co.
Hadaway Electric Heating & Eng'g Co.
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McCay Eng'g Co.
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Ft. Wayne Electric Works.
General Incandescent Arc Light Co.
Gregory Electric Co.
International Electric Co.
Jewell Electrical Instrument Co.
Keystone Electrical Inst. Co.
Machado & Roller.
Norton Electrical Inst. Co., The.
Palmer Electrical Instrument Co.
Queen & Co., Inc.
S. E. I. Co.
Siemens & Halske Electric Co.
Stanley Instrument Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Inst. Co.
Whitney Electrical Inst. Co.
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Wirt & Co., Charles.
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Field & Everett.
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Jackson, J. P.
Johnston, Thomas J.
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Mailloux, C. O.
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Pepper & Register.
Potter & Benson.
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Reid, Thorburn.
Sargent & Lundy.
Sheaff & Jaastad.
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Smethurst & Allen.
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Worstall & Co., A. M.

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Dawson & Co., A. L.
Watkins, F. M.

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Mietz, A.
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American Fire Engine Co.
Ball Engine Co.
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Leffel & Co., James.
McIntosh, Seymour & Co.
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Payne Company.
Potter Company, F. D.
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Sturtevant Co., B. F.
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Fuller Co., The.
Gordon Battery Co.
Jones & Son Co., J.
Knapp Electric & Novelty Co.
Robbins & Myers Co., The.
Sprague Electric Co.
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Ft. Wayne Electric Works.
General Electric Co.
General Incandescent Arc Light Co.
Gregory Electric Co.
Jewell Electrical Instrument Co.
Keystone Electrical Inst. Co.
Machado & Roller.
Norton Electrical Inst. Co., The.
Palmer Electrical Instrument Co.
Queen & Co.
S. E. I. Co.
Siemens & Halske Electric Co.
Stanley Instrument Co.
Vose, Ralph.
Wagner Electric Mfg. Co.
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Weston Electrical Inst. Co.
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Whitney Electrical Inst. Co.
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Kartavert Mfg. Co.
Locke, Fred M.
Massachusetts Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
Pass & Seymour (China).
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Ryle & Co., Wm. (Silk).
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Thomas & Sons, R.
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JEWELS.
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Continued on Page 44.

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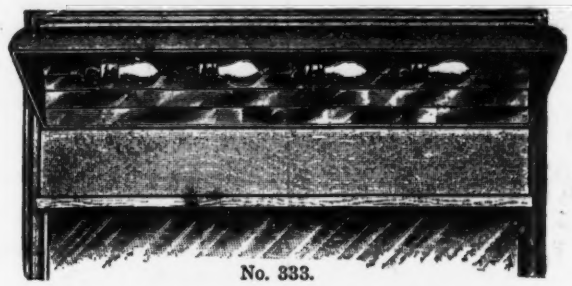

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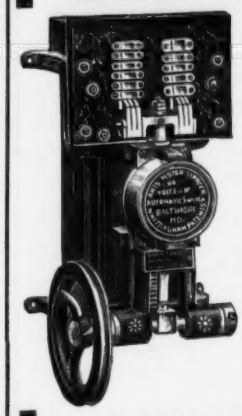

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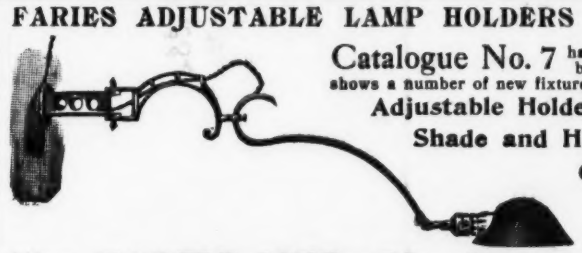

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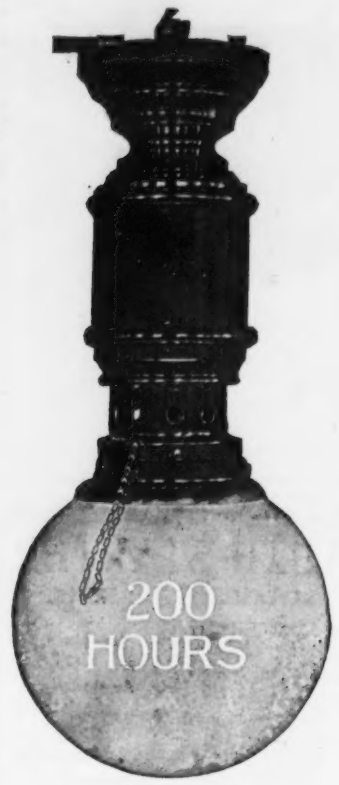

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CLASSIFIED INDEX—*Continued from Page 42.*

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Pelton Engineering Co.
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Sperry, B. N.
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Maintenance Co., The.

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Cutter Co., George.

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Mica Insulator Co.
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Varney & MacOuat.

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Phoenix Glass Co.
Wheeler Reflector Co.

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Lincoln Electric Co.
Michigan Electric Co.
Stewart Electrical Co.
Stucky & Heck Electric Mfg. Co.
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Varney & MacOuat.

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International Correspondence Schools.
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Continued on Page 46.

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Harrington & King Perforating Co.

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Carlisle & Finch Co., The
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Illinois Electric Co.
Jones & Son Co., J.
Michigan Electric Co.
Manhattan Electrical Supply Co.
Modern Electric & Mfg. Co.
Pelton Engineering Co.
Pettingell Andrews Co.
Preston, Cohen & Co.
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Russell-Tomlinson Electric Co.
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Crouse-Hinds Electric Co.
Eyanson & Armpriester.
General Incandescent Arc Light Co
Guarantee Electric Co.
Keystone Electric Telephone Co.
Kokomo Telephone & Electric Co.
La Roche & Co., F. A.
McCay Eng'g Co.
Phoenix Electric Telephone Co.
Pringle, Wm. T.
Sterling Electric Co.
Telephone Mfg. Co.
Utica Fire Alarm Telegraph Co.
Wagner Electric Mfg. Co.

SWITCHES, ETC.
Anderson Mfg. Co., A. & J. M.
Badt-Goltz Eng'g Co.
Central Electric Co.
Chase-Shawmut Co.
Cleveland Electric Works.
Crouse-Hinds Electric Co.
Cutter Electrical & Mfg. Co.
Eyanson & Armpriester.
Fagan, J. C.
Falk Company, The.
General Electric Co.
General Incandescent Arc Light Co
Hart & Hegeman Mfg. Co.
Hart Mfg. Co.
Jones & Son Co., J.
La Roche & Co., F. A.
Linton & Co., G. E.
Paiste Co., H. T.
Pringle, Wm. T.
Sterling Electric Co.
Western Electrical Supply Co.

TAPS AND DIES.
Carpenter Tap & Die Co., J. M.

TELEGRAPH INSTRUMENTS.
Bunnell & Co., J. H.

TELEPHONES.
Allen-Hussey Co.
American Bell Telephone Co.